september 1957

nlgi spokesman

journal of the national lubricating grease institute

Definitions of Terms Relating to the Lubricating Grease Industry
By W. J. EWBANK

Metal Carbonates Coated with Salts of Low Molecular Weight Polycarboxylic Acids as Grease Thickeners
By E. W. NELSON, W. W. WOODS, R. M. TILLMAN, C. R. BERGEN and W. P. SCOTT

Manufacture of Lithium Soap Grease and Calcium Soap Grease by Electric Heating
By D. F. RHODES

NLGI Annual Meeting Previews

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PUMPABILITY -- the ability of a lubrica
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NLGI Tentative Method for Matching Lubricating Grease
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FEEDABILITY -- the ability of a lubricating grease to flow to the suction of a dispensing pump at a rate at least equal to pump delivery capacity. (Some lubricating greases do not feed satisfactorily and cause cavitation at the inlet to a dispensing pump. In such cases, feedability can often be made satisfactory by the use of follower plates.)

APPARENT VISCOSITY -- the ratio of shear stress to rate of shear of a non-Newtonian fluid, calculated from Poiseuille's equation and measured in poises. (Changes with changing rates of shear and temperature, and must therefore be reported as the value at a given shear rate and temperature.)

NEWTONIAN BEHAVIOUR -- the property of simple liquids by which the rate of shear is proportional to the shearing stress. This constant proportion is the viscosity of the liquid.

NON-NEWTONIAN BEHAVIOUR -- the property possessed by some fluids and
lastic solids including lubricating grease, of having a variable relation-
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entitative value of which may vary widely with
l types of viscometers with uncontrolled
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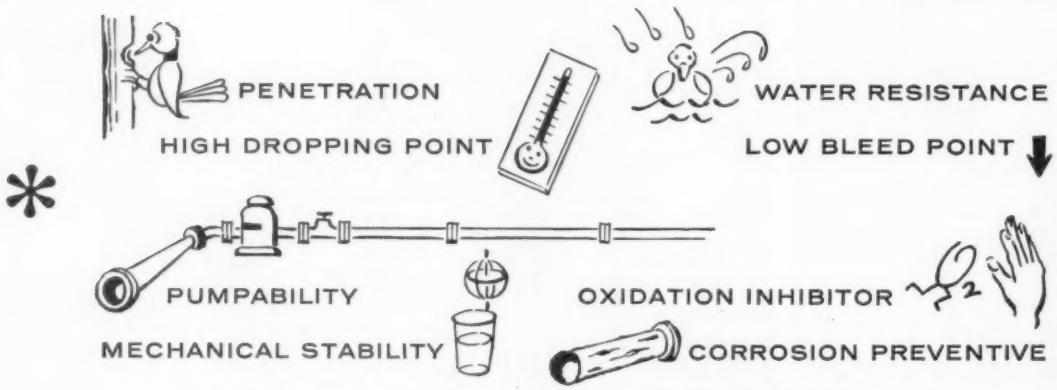

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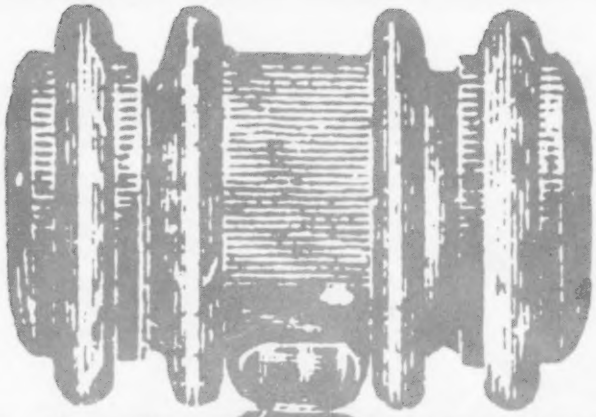

THE PRESIDENT'S PAGE

By J. W. LANE
NLGI
President

SOME MATTERS OF DEFINITION

Men spend a lot of time at the fine art of *defining*. This is necessary in the interest of efficiency—to avoid waste of time, effort and money in getting down to the real core of any matter on which two or more parties are seeking agreement. They should first decide the points agreed on, so that they may quickly arrive at those to be resolved. (see the cover and page 9).

This little preamble is by way of introduction to a matter which has lately received the Institute's attention, the legitimate field of interest of NLGI. Obviously, National Lubricating Grease Institute is interested in lubricating greases. Questions have arisen from time to time as to how broadly this may be interpreted—does the term "lubricating grease" include gear lubricants or, if it does not, can it be construed to do so? To answer this, let us look at some fundamental definitions.

In the broadest sense, a lubricating grease is a thickened oil, generally made so by the addition of a metallic soap or a suitable natural non-organic material. This definition concerns the basic composition—nothing it says can be remotely connected to the eventual uses, which are almost endless. Continuing, a gear is a fundamental mechanism, a particular version of the wheel, itself a basic machine element. Gears can be lubricated by oil or grease. Whether a specific gear assembly requires oil or grease depends on design, service, tightness of housing, and other practical considerations. Some gears work very well with lubricating grease, others require a fluid lubricant, or perform better when such a lubricant is used.

This leads us to conclude that a lubricating grease can be a gear lubricant, and that NLGI may with good reason include gear lubricants in its legitimate field of interest.

On the more formal side, your Board of Directors some time ago appointed a committee headed by Mr. H. L. Hemmingway to study and report on this matter. This Committee at the May 1957 Meeting of the Board reported as follows:

> "*Since past action by NLGI has included presentation, and publication of gear lubricant material, it was the feeling of the committee that it was never the intention of the Institute to preclude gear lubricants.*"

The Board endorsed this principle by voting unanimously that gear lubricants be considered a legitimate field of interest for NLGI, noting further that the term "gear lubricants" includes any product which can conceivably be employed in the lubrication of a gear.

Everyday usage favors this viewpoint in part. To many in the trade, a gear lubricant is and always has been "grease," whether it be a grease by definition or a material as fluid as water. On the other hand, there is a growing tendency towards using the term "grease" only in its true sense and to refer to the fluid lubricants used in gears as "gear lubricant." The API classification of gear lubricants *applying to automotive gears* favors the latter sense, since the several types included each comprehend the term "Gear Lubricant" in its definition, and the latter in turn are so worded that a fluid lubricant is implied in each.

Thus, while there is some conflict in common usage of terms, the bare logic of fundamental definitions supports our decision that gear lubricants—lubricants for gears—are properly within the NLGI orbit.

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nlgi spokesman

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THE COVER

AFTER considerable discussion and research among NLGI technical committee members, mutual agreement has been reached on the definition of terms of the lubricating grease industry. W. J. Ewbank, chairman of the committee on test methods and definitions has prepared a report of the committee's work and the definitions and test methods commonly used in the industry (beginning on page 9). It is hoped these definitions will be acceptable to all the industry and lead to better communications. Ewbank is the director of research for Cato Oil and Grease company.

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WHAT'S IN A NAME

definitions of terms relating to the lubricating grease industry

By W. J. Ewbank, Cato Oil and Grease Company

Lubricating Grease—A Solid to semi-fluid product of the dispersion of a thickening agent in a liquid lubricant. Other ingredients imparting special properties may be included.

This definition, adopted by the American Society for Testing Materials, accepted by the National Lubricating Grease Institute and quoted from the current edition of the D-2 handbook, is a good illustration of the meaning of Shakespearian statement. Although accepted by all competent authorities, it does not mean the same thing to various people, and in fact does not mean anything—unless there is equally wide acceptance of definitions of the terms used in the statement.

Recognition of this fact, and of the second fact that not all terms used in the lubricating grease industry did have commonly accepted meanings, came at the 1951 meeting of the NLGI Technical Committee. At this meeting, the members voted to establish a working group charged with arriving at definitions of the terms commonly used in the lubricating grease industry. These definitions, it was hoped, would be acceptable to all in the industry, and thus lead to improved communication within the industry, and between it and its customers.

A second assignment of the committee was to write up short descriptions of test methods commonly used in the industry.

After a survey to find out those men willing to accept responsibility for this job, the committee was organized in 1952, and promptly faced the following problems:

1. What terms (and tests) should be considered by the committee?

2. Was this work for the technologist, the salesman, the interested outside observer, or all three?

The answer to the first question was found by circulating a questionnaire to the membership of NLGI, by checking articles in the *NLGI Spokesman*, and cross-checking these words against terms used in their definitions.

The answer to the second question was obtained after considerable debate in the committee, wherein it was decided that the definitions should be useful to all

members of the industry. Therefore, the definitions as finally written give first a rigorous technical definition of the term, followed by a non-technical statement, in parentheses, giving some additional explanatory information. It is hoped that eventually when the complete set of definitions is published as a group, some illustrations can be added to the terms where it seems desirable.

It was further decided that it would be most serviceable if terms were defined by inter-related groups, so that to the greatest possible extent, when a term was defined, the words used in its definition were also defined. Therefore, the first group of terms given below relate to the general field of grease consistency.

These terms were originally worked up by members of the Committee on Definitions, then criticized by the entire committee. The group of definitions was then circulated to the whole Technical Committee for comment and discussion. All comments were carefully considered at a meeting of the Definitions Committee, and in many cases were included in the final form of the definitions adopted at this meeting.

The final definitions were then submitted to letter ballot and vote at the Technical Committee meeting in 1956, both votes being favorable. Finally, they have been given tentative approval by the Board of Directors, and are here published in the *NLGI Spokesman* for information, and with the hope that they will be used. We hope to have more definitions each year follow this same path, and would appreciate any comments, either favorable or unfavorable, which might ensue. Please mail comments to the author, c/o Cato Oil and Grease company, P. O. Box 1984, Oklahoma City 1, Okla.

In closing, I would like to express my appreciation to the current members of the Committee on Definitions, many of whom have been associated with the committee since its 1952 inception, and who have been extremely helpful in this difficult task:

A. S. Orr, Gulf Oil Corp., Vice-Chairman
C. J. Boner, Battenfeld Grease & Oil Corp.
M. L. Carter, Southwest Grease & Oil Co., Inc.
T. E. DeVilliers, Cities Service Oil Co.
J. J. Dickason, Jesco Lubricants Co.
E. M. Higgins, Master Lubricants Co.
C. E. Hulme, Kendall Refining Co.
H. C. Zweifel, Richfield Oil Co.
H. U. Fisher, California-Texas Oil Co.
T. G. Roehner, Socony-Mobil Laboratories
T. W. Miller, National Lubricating Grease Institute

Others who have been associated with the committee in some of the preparatory stages, but who are not now members, are:

H. M. Dickinson, Fiske Brothers Refining Co.
L. W. McLennan and Earl Amott, Union Oil Co. of California
Max Smart, M. W. Parsons-Plymouth, Inc.
N. J. Gothard, Sinclair Refining Oil Co.
H. E. Chapman, Georgia-Carolina Oil Co.
W. Linville, Petroleum Educational Institute
R. R. Uhrmacher, Panther Oil and Grease Mfg. Co.

W. J. EWBANK *is chairman of the committee on manual of test methods and definitions of terms in the lubricating grease industry, a project of the NLGI Technical Committee. He is director of research for Cato Oil and Grease, and NLGI technical representative.*

DEFINITIONS

APPARENT VISCOSITY—the ratio of shear stress to rate of shear of a non-Newtonian fluid, calculated from Poiseuille's equation and measured in poises. (Changes with changing rates of shear and temperature, and must therefore be reported as the value at a given shear rate and temperature.)

CONSISTENCY (HARDNESS)—the degree to which a plastic material such as lubricating grease resists deformation under the application of force. (It is therefore a characteristic of plasticity, as viscosity is a characteristic of fluidity. Consistency is usually indicated by either apparent viscosity or ASTM penetration.)

DISPENSABILITY—the property of a grease which governs the ease with which it may be transformed from its container to its point of application. Most used in discussion of dispensing in grease systems, where it includes both the properties of pumpability and feedability.

DROPPING POINT—the temperature at which a drop of material falls from the orifice of the test apparatus under the conditions of ASTM test D566-42. (This test should be considered as having very limited bearing

upon service performance. It is not the melting point of the grease, this being a term of little or no significance, when applied to plastic materials such as lubricating grease. These materials are characterized by a *melting range* during which the material becomes steadily softer. Only through the establishment of an arbitrary and fully controlled test procedure such as the ASTM Dropping Point, can any single temperature be established as a characteristic of the material. A similar test, differing only in details, the IP "Drop Point" usually gives a lower value.)

FEEDABILITY—the ability of a lubricating grease to flow to the suction of a dispensing pump at a rate at least equal to pump delivery capacity. (Some lubricating greases do not feed satisfactorily and cause cavitation at the inlet to a dispensing pump. In such cases, feedability can often be made satisfactory by the use of follower plates.)

NEWTONIAN BEHAVIOR—the property of simple liquids by which the rate of shear is proportional to the shearing stress. This constant proportion is the viscosity of the liquid.

NLGI NUMBER—a numerical scale for classifying the consistency range of lubricating greases, and based on the ASTM penetration number. NLGI grades are in order of increasing consistency (hardness) as follows:

NLGI Number	*ASTM Worked Penetration*
0	355-385
1	310-340
2	265-295
3	220-250
4	175-205
5	130-160
6	85-115

(Greases both softer and harder than this consistency range are well known in industry. Such greases do not bear an NLGI number.)

NON-NEWTONIAN BEHAVIOR—the property possessed by some fluids and many plastic solids including lubricating grease, of having a variable relationship between shear stress and rate of shear. (Non-Newtonian materials, therefore, *do not possess a viscosity* as defined by Newton, but rather an apparent viscosity, the quantitative value of which may vary widely with varying shear rate. Conventional types of viscometers with uncontrolled shear rates will not satisfactorily *measure* non-Newtonian materials.)

PENETRATION—an arbitrary measure of consistency (hardness), based on ASTM Method D217-52T (and similar methods standardized by other organizations). (All penetration measurements are in an inverse scale of consistency—that is, the softer the consistency, the higher the penetration number.)
The ASTM definitions are given as follows:

PENETRATION of lubricating grease is the depth, in tenths of a millimeter, that a standard cone penetrates the sample in a standard cup under prescribed conditions of weight, time and temperature. The penetration depends on whether or not the consistency has been altered by handling or agitation.

WORKED PENETRATION is the penetration of a sample of lubricating grease immediately after it has been brought to 77 F and then subjected to 60 strokes in a standard grease worker.

UNWORKED PENETRATION is the penetration at 77 F of a sample of lubricating grease which has received only the minimum handling in transfer from sample can to test apparatus and which has not been subjected to the action of a grease worker.

BLOCK PENETRATION is the penetration at 77 F of a sample of lubricating grease that is sufficiently hard to hold its shape.

PLASTICITY—that property of apparently solid material which enables it to be permanently deformed under the application of force, without rupture. (Plastic flow differs from fluid flow in that the shearing stress must exceed a yield point before any flow occurs.)

PUMPABILITY—the ability of a lubricating grease to flow under pressure through the line, nozzle and fitting of a grease dispensing system. It is best indicated by the apparent viscosity at moderate rate of shear. (See NLGI Tentative Method for Matching Lubricating Grease Flow Properties with Lubricating Grease Dispensing Pump Delivery Behavior at Low Temperatures.)

THIXOTROPY—in lubricating grease, that property which is manifested by a decrease in cosistency, or softening, as a result of shearing, followed by an increase in consistency, or hardening, beginning after shearing is stopped. (Thixotropic age hardening is a relatively prolonged process proportional to aging time, and is seldom if ever, complete, whereas the apparent viscosity increase which occurs in non-Newtonian systems with decreasing shear rate is instantaneous and fully reversible. Lubricating grease is *both* thixotropic and non-Newtonian.)

WORKING—subjecting lubricating grease to any form of agitation or shearing action.

YIELD POINT (OR YIELD VALUE)—the minimum force required to produce flow of a plastic material. It is estimated by the intercept on the shear stress axis of the shear stress-shear rate curve, by extrapolation of the straight portion of the curve.

YIELD (OF LUBRICATING GREASE)—the amount of grease of a given consistency which may be made with a definite amount of thickening agent. As the yield increases, % thickener decreases. ■

Future Meetings

SEPTEMBER, 1957

8-13 American Chemical Society, 132nd national meeting, New York City, site unreported.

9-12 Society of Automotive Engineers, national tractor meeting and production forum, Hotel Schroeder, Milwaukee.

10-11 Petroleum Packaging Committee, Point Edward, Ontario, Canada.

11 API Division of Marketing, Lubrication Committee meeting, the Traymore Hotel, Atlantic City, N. J.

11-13 National Petroleum Association (55th annual meeting), Traymore Hotel, Atlantic City, N. J.

18-19 Ohio Petroleum Marketers Association Fall Conference and Golf Tournament, Commodore Perry Hotel and Heatherdowns Country Club, Toledo, Ohio

22-24 Independent Oil Compounders Association Tenth Annual Meeting, Carter Hotel, Cleveland, Ohio.

22-25 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Mayo Hotel, Tulsa.

23-25 ASME, Fall meeting, Statler Hotel, Hartford, Conn.

26-27 Western Petroleum Refiners Assn., regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

30-Oct. 2 American Oil Chemists' Society (1957 Fall meeting), Netherland Plaza Hotel, Cincinnati.

OCTOBER, 1957

1-2 Texas Mid-Continent Oil & Gas Assn. (38th annual meeting), Texas Hotel, Fort Worth.

1-5 SAE National Aeronautic Meeting, Aircraft Production Forum, and Aircraft Engineering Display, The Ambassador, Los Angeles, Calif.

6-10 ASTM Committee D-2 meeting, Sheraton-Park Hotel, Washington, D. C.

7-9 ASME, ASLE-ASME Lubrication Conference, Royal York Hotel, Toronto, Ont.

7-11 American Institute of Electrical Engineers (1957 Fall general meeting), Morrison Hotel, Chicago.

9-12 SAE National Tractor Meeting and Production Forum, Hotel Schroeder, Milwaukee, Wis.

10-12 ASME, Fuels-AIME conference, Chateau Frontenac, Quebec City, Que.

13-16 API Division of Refining (midyear meeting), Penn-Sheraton Hotel, Philadelphia.

14-16 API Division of Marketing, Operations and Engineering Committee meeting, Biltmore Hotel, Los Angeles.

16-20 API Marketing Div. Marketing Research Committee, Camelback Inn, Phoenix.

28-30 NLGI Annual Meeting, Edgewater Beach Hotel, Chicago, Ill.

NOVEMBER, 1957

4-6 SAE National Transportation Meeting, Hotel Statler, Cleveland, Ohio.

5-6 SAE National Diesel Engine Meeting, Hotel Statler, Cleveland, Ohio.

6-8 Society of Automotive Engineers, National Fuels and Lubricants Meeting, Hotel Statler, Cleveland, Ohio.

11-14 API 37th Annual Meeting, Conrad Hilton and Palmer House, Chicago, Ill.

DECEMBER, 1957

1-6 ASME, annual meeting, Statler Hotel, New York City

3-4 Petroleum Packaging Committee, quarterly meeting, Hotel Washington, Washington.

MARCH, 1958

4-6 SAE Passenger Car, Body and Materials Meeting, Sheraton-Cadillac, Detroit, Mich.

31-Apr. 2 SAE National Production Meeting and Forum, The Drake, Chicago, Ill.

APRIL, 1958

16-18 National Petroleum Association, Cleveland, Ohio

JUNE, 1958

8-13 SAE Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

22-28 ASTM 61st Annual Meeting, Hotel Statler, Boston, Mass.

SEPTEMBER, 1958

10-12 National Petroleum Association, Atlantic City, N. J.

OCTOBER, 1958

20-22 SAE National Transportation Meeting, Lord Baltimore Hotel, Baltimore, Md.

22-24 SAE National Diesel Engine Meeting, Lord Baltimore Hotel, Baltimore, Md.

27-29 NLGI Annual Meeting, Edgewater Beach Hotel, Chicago, Ill.

NOVEMBER, 1958

5-6 SAE National Fuels and Lubricants Meeting, The Mayo, Tulsa, Okla.

***MARCH, 1959**

3-5 SAE Passenger Car, Body, and Materials Meeting, Sheraton-Cadillac, Detroit, Mich.

JUNE, 1959

14-19 SAE Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

*Tentative

Metal Carbonates Coated with Salts of Low Molecular Weight Polycarboxylic Acids as Grease Thickeners

By E. W. NELSON, W. W. WOODS, R. M. TILLMAN, C. R. BERGEN and W. P. SCOTT, Continental Oil Company

Presented at National Lubricating Grease Institute Annual Meeting, Chicago '56

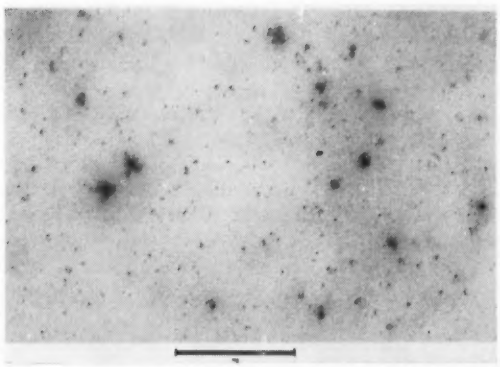


FIGURE 1 Electron micrograph of typical intermediate.

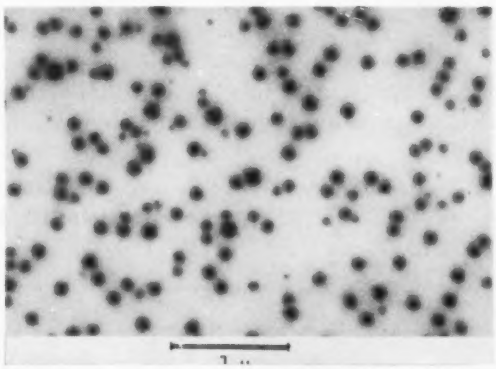


FIGURE 3 Typical base grease after solvent removal.

ABSTRACT

A grease thickener is described which consists of a colloidal dispersion of a polyvalent metal carbonate which has been coated by chemical interaction with a low molecular weight polycarboxylic acid. Use of this thickener in hexa alkoxy disiloxane fluids gives greases which show promise of utility over a −100°F to +350°F range as aircraft lubricants. This thickener is insensitive to vehicle and can also be used with other fluids to give high dropping point greases for less critical service.

Introduction

Greases used in modern jet aircraft are likely to be exposed to widely varying temperatures ranging from −100°F. to well over +450°F. Ideally, one grease capable of long service life under such conditions would be desirable. From a practical standpoint, however, few if any grease vehicles are known which are both reasonably fluid at −100°F., which are stable and nonvolatile under oxidizing conditions at high temperatures, and which are good lubricants. For this reason, there has been interest both in extreme high temperature greases and in com-

promise greases useable from −100°F. to +300°F. or +350°F. The greases described in this paper are of this compromise type.

In order to meet such a range of service requirements, a grease must differ considerably from conventional grease systems. Use of synthetic base oils having wide useful liquid temperature ranges is mandatory. The selection of a suitable gelling agent is also important. A number of thickeners have been described in the last several years that have shown varying degrees of success over wide temperature applications. Insomuch as considerable effort has been expended upon development of greases from these thickeners without producing an entirely satisfactory product, it was decided to try a novel mixed organic and inorganic thickener for this development.

Thickener Formation

This thickener consists of a colloidal dispersion of a polyvalent metal carbonate which has been coated through chemical interaction with a low molecular weight polycarboxylic acid. The result is a polymeric metal salt which is highly insoluble in customary vehicles even at very high temperatures.

Greases utilizing these novel thickeners are usually prepared in three steps. The first two of these operations involve the preparation of an intermediate containing a colloidal dispersion of the metal carbonate. The third is concerned with conversion of this liquid intermediate into a grease.

The first step in preparing the intermediate involves obtaining a solution of the metal in an organic solvent. In a calcium system, for example, the following reaction is used to obtain this organic solution of a metal salt.

$$CaO + 2H_2S \xrightarrow{\text{methanol}} Ca(SH)_2 + H_2O$$

A calcium oxide slurry in methanol is blown with hydrogen sulfide, and the resulting calcium sulfhydrate is soluble in methanol. This solution is dark green-black in color and decomposes slowly with the evolution of H_2S. It is sufficiently stable to be kept in a refrigerator for a period of two or three months without significant deterioration.

The colloidal calcium carbonate dispersion is formed in a second step from the calcium sulfhydrate solution by the simple expedient of blowing with CO_2 as shown in the following reaction:

$$Ca(SH)_2 + CO_2 + H_2O \longrightarrow CaCO_3 + 2H_2S$$

In practice an alkyl aryl sulfonic acid sufficient to neutralize 20 to 30 per cent of the calcium is added to the mixture prior to the formation of the $CaCO_3$. This acts as a dispersing agent for the system and tends to keep the ultimate particle size well within the colloidal range. Another factor that influences ultimate particle size is the concentration of the reactants. To insure uniformly small particle size, a large excess of solvents is used, a portion of which is the base oil to be used in the final grease. The bulk of the excess solvent, however, is of volatile nature. After the reaction is complete as indicated by a faint or negative test for H_2S in the effluent gas stream, the volatile solvents are stripped; and the calcium carbonate dispersion in base oil is obtained. Figure 1 shows an electron micrograph of a typical

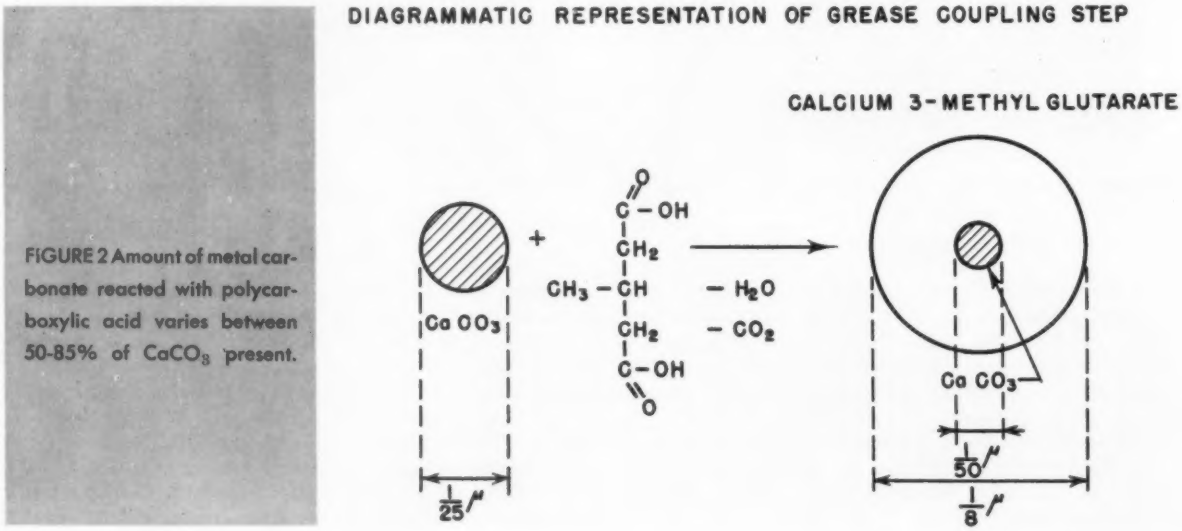


FIGURE 2 Amount of metal carbonate reacted with polycarboxylic acid varies between 50-85% of $CaCO_3$ present.

intermediate prepared in this manner. In appearance these intermediates are dark reddish-brown in color and bright when viewed in thin sections. They are mobile liquids in consistency and are stable indefinitely in storage.

In order to prepare a grease from such colloidal dispersions, it is necessary to react a portion of the metal carbonate with an aliphatic polycarboxylic acid of low molecular weight. The amount of the metal carbonate that is reacted with the polycarboxylic acid is termed the conversion ratio and varies between 50 and 85 per cent of the $CaCO_3$ present. This partial neutralization is carried out in a solvent system to minimize the ultimate particle size. Figure 2 shows diagramatically what takes place in this reaction. Particles of $CaCO_3$ of approximately 1/25 micron diameter are reacted with 80 per cent of the theoretical amount of 3-methyl glutaric acid necessary for neutralization. The resulting particles are approximately ⅛ micron in diameter having a core of $CaCO_3$ of a diameter equal to ½ of the original diameter. No gelation occurs, however, until a portion of the volatile solvents are removed. Figure 3 shows an electron micrograph of a typical base grease after solvent removal. Figure 4 is a compositional graph of this grease.

As might be expected, the ratio of constituents used in this preparation has a profound effect on the finished grease. It has been found that three of these variables can be used to predict the nature of the greases formed. The first of these variables is the quantity of sulfonic acid used in the intermediate preparation. Figure 5 shows the effect of varying sulfonic acid contents on the particle size of the intermediates. It can be seen that as sulfonate content is decreased the particle size has a tendency to increase. The second compositional variable is the conversion ratio mentioned previously. This is the amount of available $CaCO_3$ that is neutralized by the polycarboxylic acid. The third determining variable is the amount of active gelling agent used. Included in the category of active gelling agents are the unreacted metal carbonates and the metal salts of the polycarboxylic acid. Figure 6 shows a study of grease consistency using a diester vehicle at varying sulfonic contents at a fixed conversion ratio and active gelling agent.

Choice of Base Fluid

A large portion of recent experimental work has been directed toward finding a suitable base fluid. Previous work with this type of thickener had been restricted to petroleum oils which, of course, have limited utility. The gelling agent fortunately is relatively noncritical with respect to the nature of the base fluid. The only requirement imposed by the thickener is solvency for the sulfonate dispersing agent used to stabilize the dispersion.

The first of the synthetic fluids to be evaluated were the silicones. It was realized that lubricity could be a problem in such a system, but the outstanding viscosity-temperature relationships available in these compounds could not be overlooked. Suitable intermediates, however, could not be made from any available methyl or methyl phenyl silicone fluid using the intended thickening agent because of lack of solvency for the dispersant.

The next class of synthetic base oils investigated were

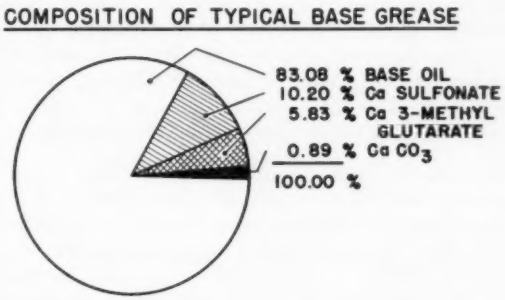


FIGURE 4 Graph of same grease micrographed in figure 3.

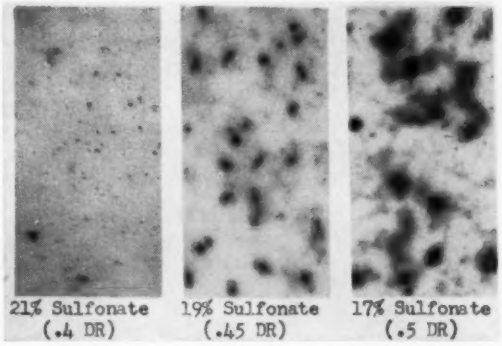


FIGURE 5 shows the effect of varying sulfonic acid contents on the particle size of the intermediates.

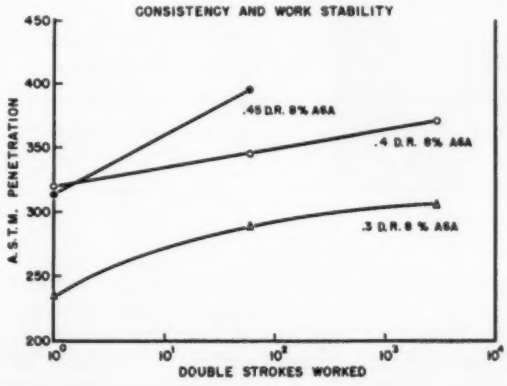


FIGURE 6 Study of grease consistency using a diester vehicle at varying sulfonic contents at a fixed ratio.

the aliphatic diesters. The wide temperature requirements in the finished grease precluded all but a few of the diesters from consideration. While greases could be readily made using these vehicles, no diester was found that had both the prerequisite high and low temperature properties. The most serious problem encountered was volatility at 350°F. This volatility was found to be brought about by oxidation of the diesters and subsequent volatilization of these oxidation products. A large number of oxidation inhibitors were evaluated, but none were found that were sufficiently active to reduce this volatilization to within desirable limits. Similarly, greases formed in these diesters showed at −100°F. apparent viscosities somewhat higher than desirable.

The last and most promising class of base oils to be evaluated have been the silicate esters. One of the primary objections to silicate esters has been the hydrolytic instability of these fluids. Working with hexa alkoxy disiloxanes, however, no difficulty has arisen in this respect. These fluids have good lubricity properties, good thermal properties, and excellent solvency for the sulfonate dispersant. Transition from diester systems to silicate esters was accomplished without difficulty. The greases prepared from silicate esters have proved equal to or superior in all respects to those prepared from diesters. Critical properties of these two types of greases are shown in the following table.

Grease Properties

Test	*Aliphatic Diester*	*Silicate Ester*
	Di-2-Ethyl hexyl azelate	*Hexa (n-Ethyl hexoxy) disiloxane*
Apparent Viscosity at −100°F., 16 sec.−1	30,000 poises	15,000 poises
Low Temperature Torque	2 seconds	2 seconds
350°F. High Speed Bearing Test	60-70 hours	350 hours
Navy Gear Wear Test—5-Pound	2.7 mg/1,000 cycles	1.7 mg/1,000 cycles
Navy Gear Wear Test—10-Pound	5.5 mg/1,000 cycles	3.7 mg/1,000 cycles
Water Washout	40 per cent	15 per cent
Per-Cent Oil Separation	2 per cent	2 per cent

Penetrations on these greases were in the 280-320 range, and both showed dropping points in excess of 450°F. They contained, in addition to thickener and antioxidant, a work stability additive. Figure 7 shows the effect of such an additive, a poly methyl phenyl siloxane, on work stability. The effect this material has on the particles within the grease is quite interesting and can be seen in Figure 8. The upper limit for this additive is in the range of 12 per cent. Above this point, compatibility with the sulfonate dispersant becomes a problem. Lubricity does not suffer from this small addition of silicone. Greases containing such additives are clear and are generally similar in appearance to lithium all-purpose greases.

A number of compositional modifications have been recently worked out in a hexa (2-ethyl butoxy) disiloxane system whereby high temperature bearing life has been substantially increased. It is hoped that incorporation of these modifications in the higher molecular weight analog, hexa (2-ethyl hexoxy) disiloxane, will result in greases with high temperature performance characteristics considerably exceeding the present limit.

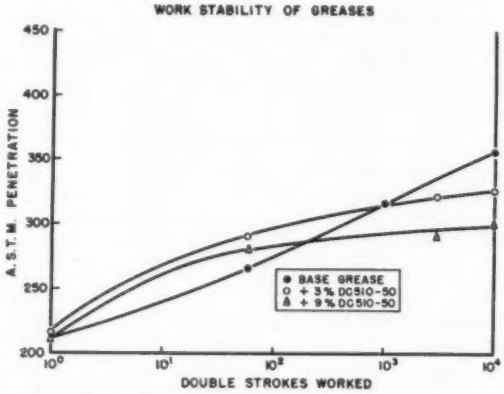


FIGURE 7 shows the effect of the additive on work stability.

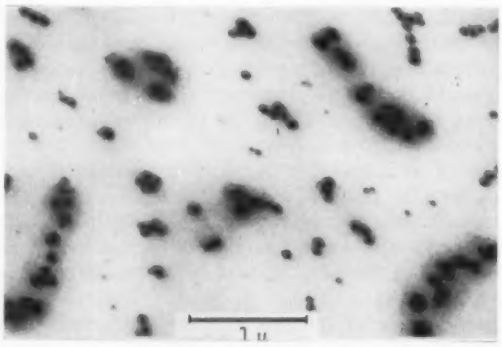


FIGURE 8. The effect of poly methyl phenyl siloxane on the particles within the grease is quite interesting. Upper limit for this additive is in range of 12 per cent.

Summary of Thickener Attributes

The thickener used in the greases just described is

basically a compromise between inorganic and conventional soap thickeners and as such gives some of the properties of each. Like the inorganic thickeners, it is relatively insensitive to vehicle and gives greases of very high dropping points. Unlike some inorganic thickeners, however, a fairly low quantity is required to obtain desired consistencies. Similarly, resistance to water is intermediate between soap and inorganic thickened greases. This balance of properties is regarded as essential for a wide temperature range aircraft lubricant.

Acknowledgement: Application of this thickener to greases utilizing synthetic vehicles has been studied under research contract AF33(616)-2364 between the U. S. Air Force and Continental Oil Company. This work was monitored by the Materials Laboratory, Directorate of Research, Wright Air Development Center.

About the Authors

E. W. Nelson's *entire industrial career has been primarily in the field of petroleum where his specialty has been lubricating greases and cutting oils. He is a member of ACS and has been an active participant in the affairs of ASTM and NLGI where he has been a vice-chairman of the Technical Committee for two years. He is a graduate of Bethany college and received his M.S. from Minnesota.*

W. W. Woods *has been with Continental Oil company's development and research for the past six years where he is a supervising research chemist. Prior to that he spent five years in research with Socony Mobil Oil company. His specialized field is colloid chemistry. His B.S. degree is from Stanford University.*

R. M. Tillman *has been a member of Continental's research department for the past three years, where his particular field of endeavor has been in product development. He received his B.S. and M.S. from Southern Methodist University.*

C. R. Bergen *obtained his B.S. degree in chemistry from Bethany-Peniel College in Oklahoma. He then joined the research department of Continental Oil company and has devoted his time to the problems relating to grease research and development.*

W. P. Scott *served two years in the army, after which he re-entered school and received his B.S. degree in chemistry from Northeastern State college of Oklahoma. Scott joined the research department of Continental Oil company three years ago, and since that time he has worked on the development of specialized greases.* ■

MANUFACTURE OF LITHIUM SOAP GREASE AND CALCIUM SOAP GREASE BY ELECTRIC HEATING

By D. F. Rhodes, Canadian Oil Company, Ltd.

Presented at National Lubricating Grease Institute Annual meeting, Chicago '56

CANADIAN OIL COMPANIES, Limited, manufacture calcium and lithium soap grease at their Montreal lubricating oil and grease manufacturing plant by the use of electric heating.

The mixing equipment used for this operation consists of: Stratford Engineering corporation contactor of 3000 lb. capacity for making both the lithium and calcium soap, a Stratford paddle mixer of 8000 lb. capacity for processing lithium grease, an "open-topped" conventional type paddle mixer for the calcium soap grease.

These vessels in Table 1 are marked V. 10, V. 11 and V. 1 respectively in the Tables. The characteristics of the grease produced are given in Table 2.

The following auxiliary equipment is used: Manton Gaulin homogenizer, Morehouse Industries deaerator, Cuno Engineering filter, Viking grease pumps, Byron Jackson centrifugal heating oil pump, Nash Engineering vacuum pump. Specifications of these items are given in Tables 3 and 4 (page 20).

The Stratford contactor is electrically heated by hot mineral transfer oil flowing from a tubular multipass fluid heater designed by L. P. Hynes, Haddonfield, New Jersey. The form, construction, operation and engineering detail of this electric operated oil heater is the main subject of this paper. Tables 5, 6, 7 and 8 illustrate construction of the heater, and Table 9 gives specifications.

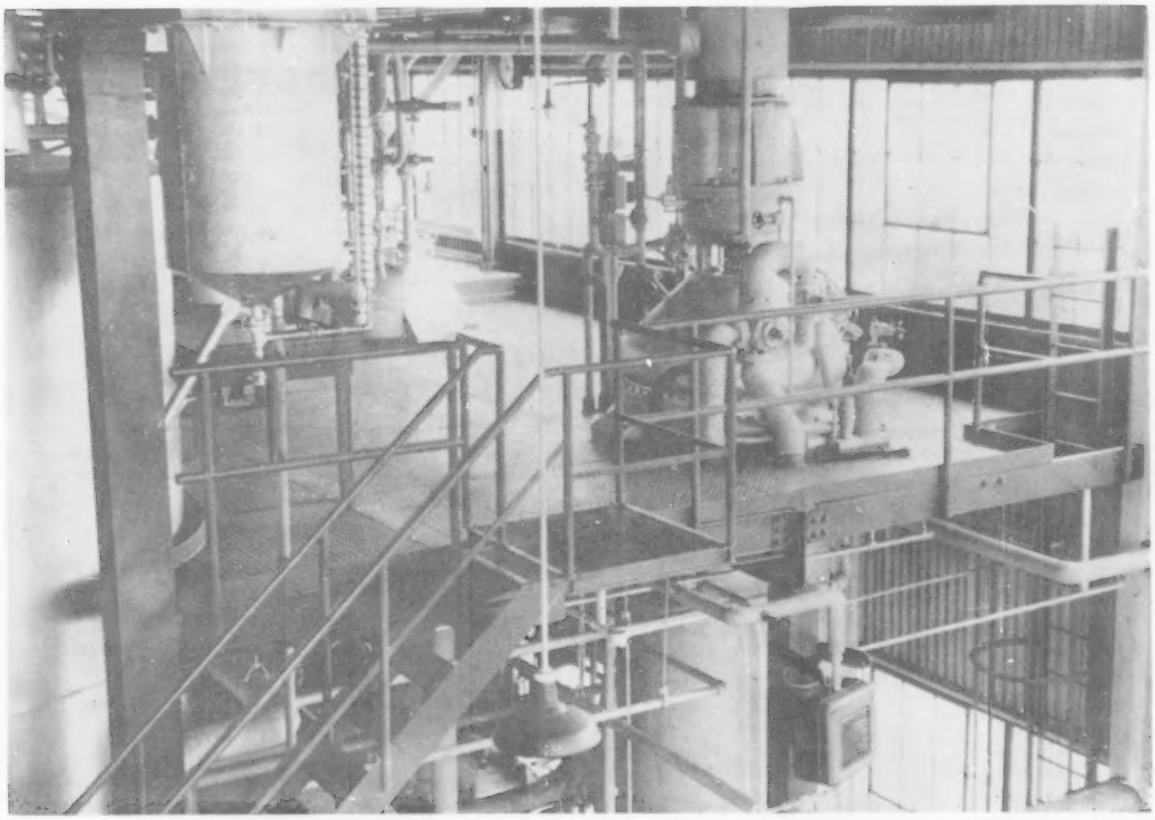
The electric heater, used in our Montreal plant, was the first one of this design constructed in Canada and built by J. & R. Weir Limited, Montreal, at a cost of approximately $3,000, not including switchgear and installation.

The heat transfer oil used in the Montreal plant is a 200 S.U.S. at 100°F. solvent treated paraffine oil. Table 10 contains information on the oil after being used continuously for heating 128 batches of grease.

The transfer oil is circulated by a centrifugal pump

through the heater and into the contactor inner and outer jackets as illustrated in Table 11. Electric power at 550 volts is supplied to the heater from a switch gear room 150 feet remote from the heater. Control lines from the heater thermostat are 110 volt. See Table 12. It is customary to process calcium soap in the contactor at 320°F and lithium at 410°F. When this is done the thermostat is set at either of these values and material in the contactor assumes the respective temperature.

The average electrical cost per pound of grease produced over a first ten months of operation was 0.13 cents. This is derived by two different methods as shown in Tables 18 and 19. Table 20 contains relationship of total plant electrical expense over a thirteen month period to grease production and use of heater. Table 21 shows grease production versus Kilowatt Demand Meter and Kilowatt Hour Meter.



A GENERAL view of Canadian's mezzanine floor showing parts of Stratford equipment which consumes two floors.

Tables 13 and 14 show the conduit arrangement on the ceiling of the grease plant main floor and mezzanine.

The building of the grease manufacturing equipment into Montreal plant in 1954 resulted in adding an electric load of 150 K.W. for the oil heater and 128 H.P. for motors. The three 333 K.V.A. transformers serving the plant could carry this extra load but the control board was extended about 6 feet to house the switch gear for the heater, homogenizer and two Stratford vessels. See Tables 15 and 16.

The flow sheet of the grease plant is given in Table 17.

The instrumentation on the processing vessels and auxiliary equipment of the grease plant is shown in Tables 22 and 23. The safety features built into the equipment are contained in Table 24.

The grease plant was built on an 18-inch reinforced concrete main floor and a steel mezzanine floor. Table 25 contains detail of the steel beams used for the mezzanine. The grease vessels are served by a mono rail as illustrated in Table 26. *Continued on next page*

Table 1

Data on Grease Processing Vessels

Name	V. 1	V. 10	V. 11
Use	Calcium Grease	Soap	Lithium Grease
Type	Paddle 1 Way	Contactor	Paddle 2 Ways
Manufactured by	Canadian Oil Cos. Ltd. Refinery	Stratford Engineering Co.	Stratford Engineering Co.
Full Capacity	9,000 lbs.	3,300 lbs.	9,000 lbs.
Motor hp.	15	30	30
Motor Location	Top	Bottom	Top
Speed	1 Way 30 rpm	1 Way 1,750 rpm	(3) 68, 45, 34 (3) 41, 27, 20
Heated by	10 psig Steam	Hot Oil	10 psig Steam
Vacuum	No	Yes	Yes
Width, Feet	7	4	5
Height, Feet	8	13	16
Shell Strength	Not Pressure Vessel	150 psig	150 psig 75 psig
Heating Jacket Cooled by	150 psig Nil	75 psig Nil	City Water 80 Gals. per min.
Empty Wt.	4,850 lbs.	16,000 lbs.	30,000 lbs.

Table 2

Grease Production Characteristics

Type of Soap	Calcium	Lithium
Made in Vessel	V. 1	V. 11
Color	Natural Brown	Dyed Light Green
Stringiness Additive	Present	
Grade N.L.G.I.	No. 1	No. 2
Fatty Material Charged to Vessel V. 10	Fatty Oil	Hydrogenated Fatty Oil
Processing Temp.	320° F. Max.	410° F. Max.
Penetration at 77° F.		
Unworked	280-310	265-295
Worked 60 strokes	300-330	265-295
Worked 10,000 "	350 Max.	265-295
Melting Point °F.	190 Min.	355 Min.
Fatty Material %	10.1	8.2
Water %	0.9 Max.	Nil
Mineral Oil Viscosity	300 S.U.S. at 100° F.	600 S.U.S. at 100° F.
Viscosity Index	58	55

Table 2 (Continued)

Table 3

Grease Processing Equipment Specifications

Equipment	Cuno Filter	Homogenizer	Deaerator
Manufacturer	Cuno Engineer Corp.	Manton-Gaulin Mfg. Co.	Morehouse Industries Ltd.
Type	M.P.M. Auto Kleen 4.4" x14" Steel Cartridge Spaced 0.008"	K-12-5 BS Single Stage Capacity 5,200 lbs. of Grease per Hour	B-1405 Model F. Capacity up to 28,000 lbs. per hr. Round Hopper
Motor hp.	1/16	40	20
Operating Temperature °F.	100-250	80-200	100-200
Maximum Pressure	200 psig Possible to purge with air at 100 psig	5,000 psig	26" Hg. Vacuum

Table 4

Pump Data and Specifications

Service	Grease Pumping under Vessels V. 1 and V. 11	Circulating Heating Oil	Vacuum on Vessels V. 10 & V. 11
Manufacturer	Viking Pump Co.	Byron Jackson Ltd.	Nash Engineering Co.
Model	ZQ Size 4	2x3x8H-SM.	AL-673
Type	Rotary	Centrifugal	Rotary + Water
Drive	Gear Reducer	Direct	Direct
Motor Size hp.	7½	10	3
Motor rpm	720	3,600	1750
Pump rpm	125	3,600	1750

About the Author

D. F. RHODES *is the assistant to the manager of manufacturing at the Sarnia refinery of Canadian Oil Companies, Ltd. Starting with the company in* 1936 *as a chemist he achieved the position of chief research chemist in* 1951. *Rhodes is a graduate of Sarnia Technical school and McMaster university. His principal field of study was mathematics and physics. He then began to do postgraduate work at Western Reserve university and continued at McGill univeristy. Rhodes' professional affiliations include the Chemical Institute of Canada, SAE, ASTM, the Chek-Chart advisory board of engineers and the Engineering Institute of Canada.*

Table 4 *(Continued)*

Pumping Temperature ° F.	50-400	50-460	50-250
Volume U.S. gals. per min.	65	150	60 lbs. Air or Steam per hr.
Discharge Pressure Max.	75 psig	70 psig	14.7 psig
Suction Pressure Max.	0 psig	4.6 psig	27" of Hg.
Cooling	None	Water on Bearings	3 gals. of water per min. as seal
Maximum Viscosity	40,000 S.U.S. at Pumping Temp.	15,000 S.U.S. at 100° F.	

Table 5

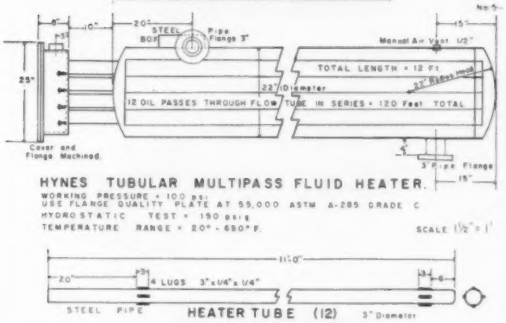

HYNES TUBULAR MULTIPASS FLUID HEATER.
WORKING PRESSURE = 100 psi
USE FLANGE QUALITY PLATE AT 55,000 ASTM A-285 GRADE C
HYDROSTATIC TEST = 150 psig
TEMPERATURE RANGE = 20° - 650° F.
SCALE 1½" = 1'
TOTAL LENGTH = 12 Ft.
12 OIL PASSES THROUGH FLOW TUBE IN SERIES = 120 Feet TOTAL
22" Diameter
Manual Air Vent 1/2"
3" Pipe Flange
Cover and Flange Machined
4 LUGS 3"x1/4"x 1/4"
STEEL PIPE
HEATER TUBE (12)
3" Diameter

Table 6

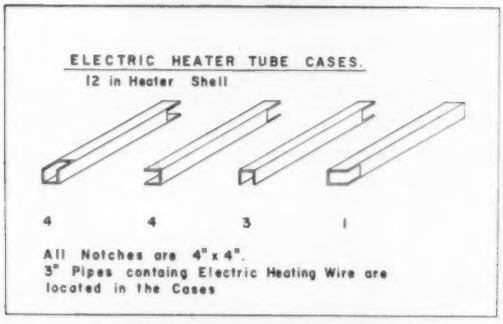


Table 7

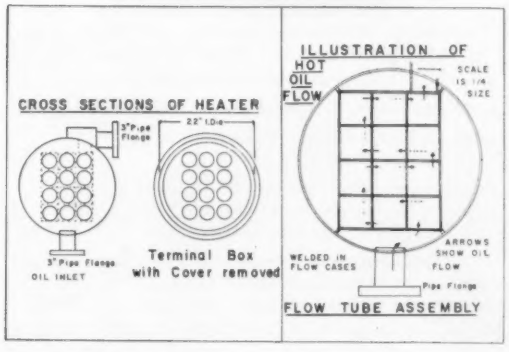


Table 8

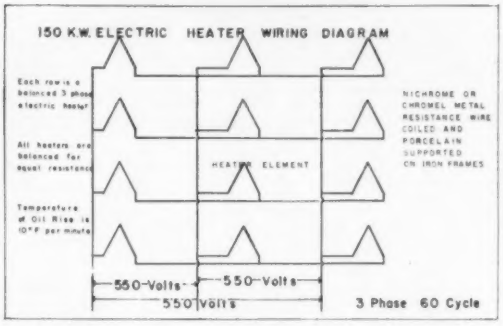

150 K.W. ELECTRIC HEATER WIRING DIAGRAM
Each row is a balanced 3 phase electric heater
All heaters are balanced for equal resistance
Temperature of Oil Rise is 10° F per minute
NICHROME OR CHROMEL METAL RESISTANCE WIRE COILED AND PORCELAIN SUPPORTED ON IRON FRAMES
HEATER ELEMENT
550 Volts
550 Volts
550 Volts
3 Phase 60 Cycle

Table 9

Electric Hot Oil Heater Specifications

Designed by Lee P. Hynes, 36 West End Ave. Haddonfield, N. J.

Built by J. & J. Wier & Co., Montreal, Canada

Temperature = Oil Inlet 435° F. Max. Oil Outlet 460° F. Max.

Heat Density = 8-9 Watts per Sq. In. of heating surface

Heat Transfer Oil, Viscosity SUS 100° F. = 200 V. I. = 100

Flash/Fire = 425/480. Sp. Gr. = 0.87 60° F.

Pumping Conditions = 140 Gals. per Min. at head of 55 psig or 146 ft.

Pressure Drop through Heater to be 10 psig Maximum

Power = 150 Kilowatts, 550 Volts. 60 Cycle, 3 Phase

Control Switch = 110 V. Adjustable Range of 200° F.-600° F.

Inlet and Outlet Pipe Flanges are 3-inch.

Speed of Oil Flow through Heater is 7 linear feet per second Min.

Working Pressure = 100 psig. Passing A.S.M.E. Code Passing Province of Quebec Electrical Regulations

Table 10

Information on Heating Oil Used in 150 KW Electric Heater

Oil used is Cit-Con 8020 (200 S.U.S. at 100°F.). No Oxidation Inhibitors added.

Date	Vis. S.U.S. 100° F.	V.I.	Color A.S.T.M.	Flash COC °F.	Fire COC °F.	Neut. No.	C.C.R. %	Ash %	Number of Times Oil Was Heated to 320°	to 410°	Total Heats
Unused Oil	205.0	98	1	425	490	0.02	0.00	Nil	0	0	0
July 1,'55	205.9		3			0.03			0	0	0
Jan. 23,'56	204.3		3¼			0.03			37	17	54
Feb. 7,'56	203.8		3¼			0.03			45	18	63
Feb. 27,'56	203.1		3¼			0.03			50	21	71
Mar. 20,'56	201.6		3¼			0.03			62	25	87
April 8,'56	201.5		3½			0.03			72	29	101
April 22,'56	201.4		3½			0.04			78	33	111
May 18,'56	201.0	96	3¾	430	490	0.04	0.06	0.005	92	36	128

Table 11

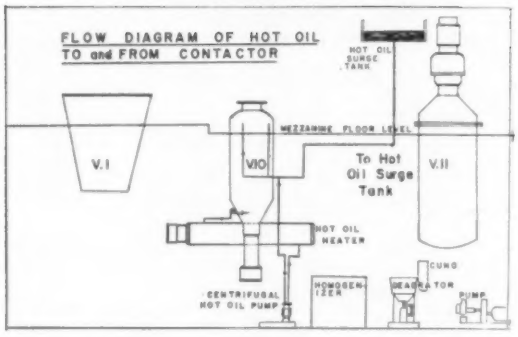


Table 12

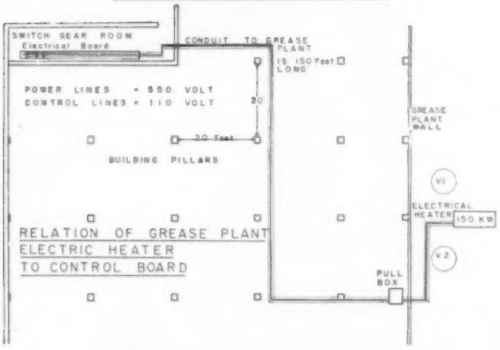


Table 13

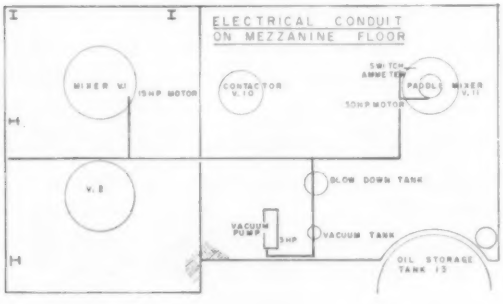


Table 14

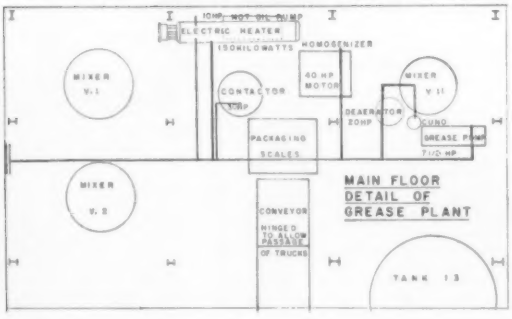


Table 15

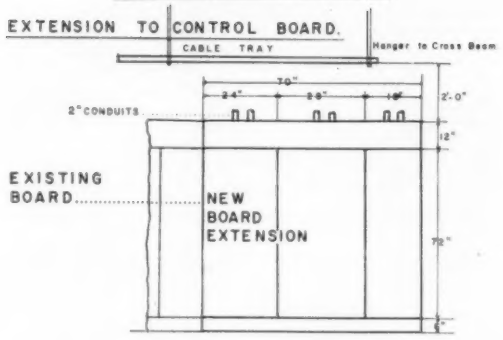


Table 16

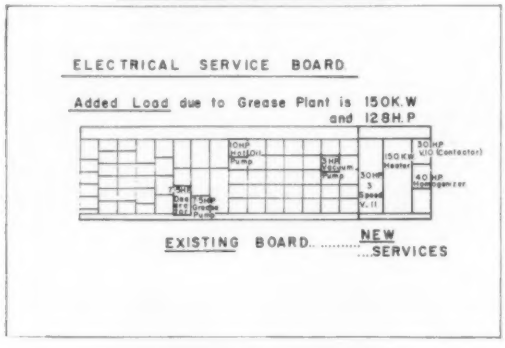


Table 17

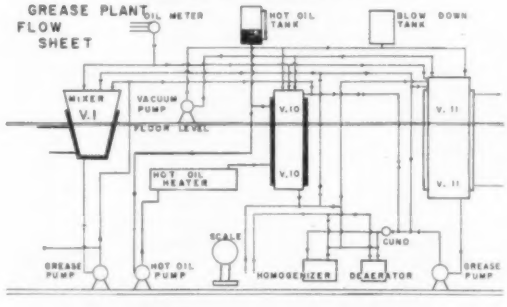


Table 18

Calculation of Average Heating and Motor Cost for Making 1 Pound of Calcium or Lithium Grease Kilowatt Hour Meter Used

Total Production of Grease for 10 Months=877,785 lbs.

Total Electrical Bill for These 10 Months for Whole Plant $7,721.21

Total Electrical Bill for the Whole Plant for the 10 Months Immediately Prior to Start of Grease Manufacture..... $6,599.83

Incremental Electrical Expense Attributed to Grease Manufacture During the 10-Month Period $1,121.38

Electrical Cost per Pound of Grease = 0.127c.

Table 19

Calculation of the Electrical Cost of Making 1 Pound of Lithium Grease in Montreal Plant

Cost of Electrical Power from July, 55 to April, 56 = $7,721.21

Kilowatt Hours used during this period = 488,000

Cost of Electricity = $\frac{772{,}121c}{488{,}000}$ = 1.58c per KWH

Kilowatt Hours Used for 1 Batch (8500 lbs.) of Lithium Grease

1 Electric Heater .....150 KW for 3 hrs.=450 KWH
2 Electric Heater Pump..10 H.P. for 3½ hrs.= 26 KWH
3 Contactor Motor (v10)..30 H.P. for 2 hrs.= 45 KWH
4 Paddle Mix. Motor (v11) 30 H P. for 3 hrs.= 67 KWH
5 Homogenizer Motor.....40 H.P. for 2 hrs.= 60 KWH
6 Viking Pump .....7½ H.P. for 3 hrs.= 17 KWH
7 Vacuum Pump .....3 H.P. for 2 hrs.= 5 KWH

Total Kilowatt Hours=670 KWH

Electrical Cost=670 x 1.50=$10.30

Electrical Cost per Pound of Grease=0.125 cents

NOTE: *This calculation assumes a power factor of* 1.0 *and* 100% *motor load.*

Table 20

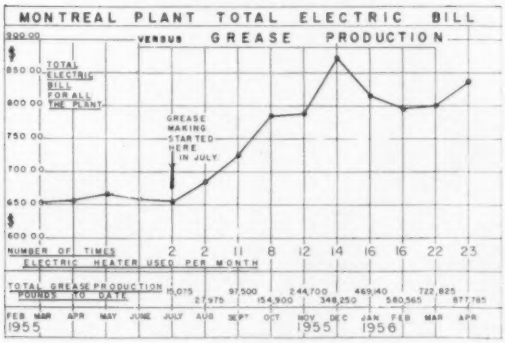

MONTREAL PLANT TOTAL ELECTRIC BILL
VERSUS GREASE PRODUCTION
$
850 00
800 00
750 00
700 00
650 00
600 00
TOTAL ELECTRIC BILL FOR ALL THE PLANT
GREASE MAKING STARTED HERE IN JULY
NUMBER OF TIMES ELECTRIC HEATER USED PER MONTH
2 2 11 8 12 14 16 16 22 23
TOTAL GREASE PRODUCTION POUNDS PER DATE
15,075 27,975 97,500 154,900 244,700 348,250 469,140 580,565 722,825 877,785
FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR
1955 1955 1956

Table 21

Grease Plant Electrical Consumption vs. Cost and Production

Month	*Demand Meter KW*	*KWH Meter Total*	*Total Bill*	*Batches Per Month*	*Prod. Per Month*	*Total Grease Prod.*
Mar. '55	270	37,800	652.03			
April '55	270	38,027	654.45			
May '55	270	39,600	664.42			
June '55	270	38,400	656.84			
July '55	276	36,000	650.89	2	15,075	15,075
Aug. '55	276	40,800	681.21	2	12,900	27,975
Sept. '55	310	38,400	721.27	11	69,525	97,500
Oct. '55	312	50,000	780.63	8	57,400	154,900
Nov. '55	312	50,400	784.09	12	89,800	244,700
Dec. '55	336	63,600	869.65	14	103,550	348,250
Jan. '56	324	51,600	812.25	16	120,890	469,140
Feb. '56	320	50,000	790.23	16	111,425	580,565
Mar. '56	312	55,200	797.08	22	142,260	722,825
April '56	336	50,400	833.91	23	154,960	877,785

Table 22

Instrumentation

Name of Vessel	V. 1	V. 10	V. 11
Process	Calcium	Soap	Lithium
Temperature Indicator	X	X	X
Ammeter on Motor Circuit		X	X
Vacuum Gauge		X	X
Pressure Gauge		X	X
Pressure Gauge on Jacket			X
Pressure Safety Valve		X	X

Table 23

Instrumentation

	Grease Pump under V. I	*Grease Pump under V. II*	*Vac-uum Pump*	*Hot Oil Pump*	*Elec. Hot Oil Heat.*	*Gaulin Hom-ogen-izer*	*Hot Oil Surge Tank*
Pressure Gauge on Suction		X	X	X		X	
Pressure Gauge on Discharge	X	X		X		X	
Temperature				Indicator on Heater Inlet and Outlet			
Visible Level Gauge							X
Electric Shut Off							
Switch for Excessive Pressure				X	X		

Table 24

List of Special Safety Features

1. Electrical Fixtures of "Weather Proof" Type.
2. Mezzanine Floor is Oil Tight with 4" Curb in case of Vessel Spill.
3. Monorail for Handling Drums and Materials.
4. Mezzanine Area Has 3 Exits.
5. Heater is Protected by Pressure Switch Cut Out set at 70 psig which equals 4 feet per second oil flow in heater tubes.
6. Heater is off unless Hot Oil Pump is running.
7. Plug Type Valves on Homogenizer Discharge are drilled to prevent shut off against 4300 psig when plug is turned.
8. Safety Valve set at 150 psig put on Homogenizer Discharge.
9. Fiber Pinion Gear on Grease Pump.
10. Relief Valve and Bypass on Grease Pumps.
11. Rupture Disc on Vessel V. 10 (Contactor).
12. Safety Valves on Vessels V. 10 and V. 11.

Bursting Pressure of Rupture Disc is 195 *psi at* 72°F. *and* 159 *psi at* 400°F.

Continued on next page

Rhodes—*Continued from page 23*

Table 25

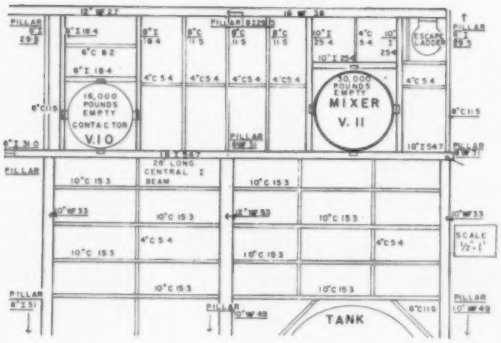
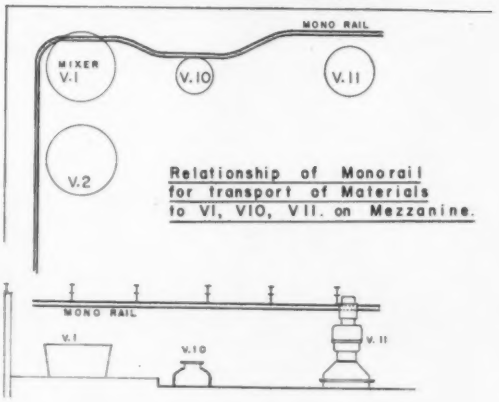


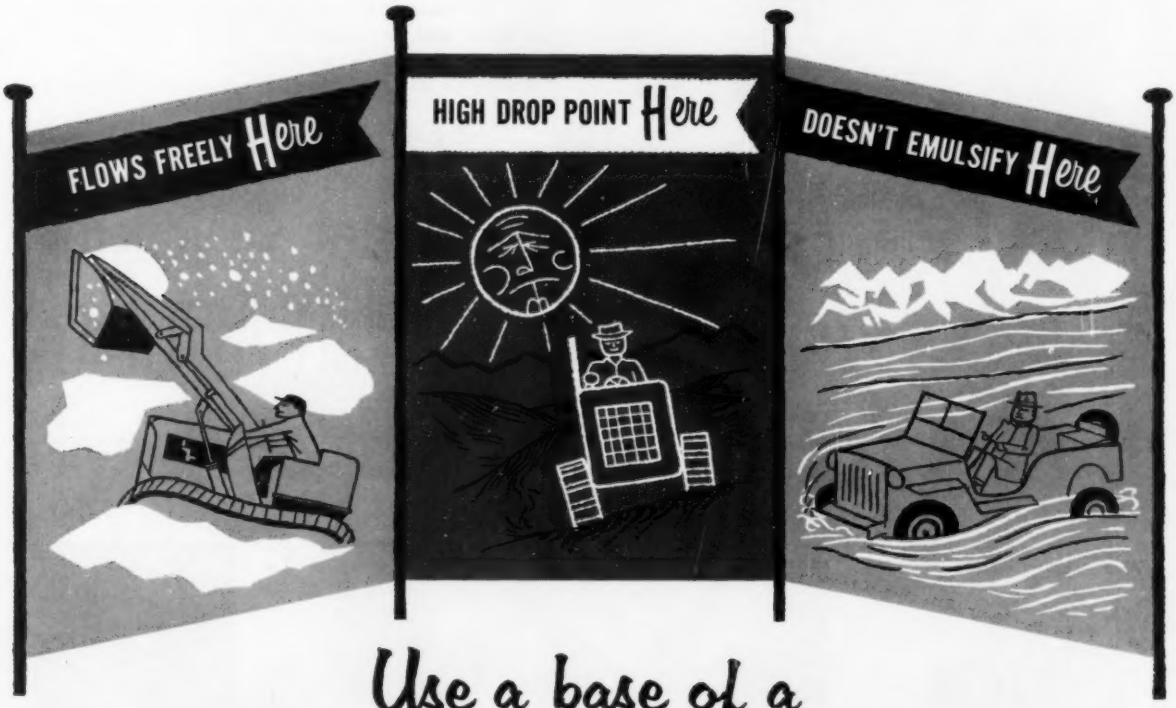
Table 26



Relationship of Monorail for transport of Materials to VI, VIO, VII. on Mezzanine.

NLGI ANNUAL MEETING PREVIEWS (Pages 44-45)

For greases you can send anywhere —make economically, too



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Technical Committee Column

CHAIRMAN T. G. ROEHNER, Manager, Technical Service Laboratory, Socony Mobil Oil Company, Inc.

The last issue of the Technical Committee Column reported the highlights of the first meeting of the Joint SAE-NLGI Committee on Chassis Lubricants held on June 4, 1957 at Atlantic City. Mention was made of the agreement by the NLGI representatives to prepare a write-up of the "Recommended Practices for Lubricating Ball Joint Bearings." The first step has been taken on this assignment. A rough draft has been prepared and is being circulated within the NLGI Technical Committee for comment preparatory to its consideration by the Joint Committee.

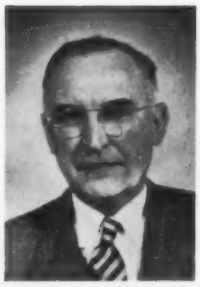
Subcommittee Chairmen of NLGI Technical Committee

T. G. ROEHNER
Socony Mobil Oil Co., Inc.
Chairman
Technical Committee

P. V. TOFFOLI, JR.
(Photograph not available)
Pure Oil Company
Recommended Practices

L. C. BRUNSTRUM
Standard Oil Co. (Indiana)
Vice Chairman,
Technical Committee

E. W. NELSON
Continental Oil Co.
Vice Chairman,
Technical Committee



E. W. ADAMS
Standard Oil Co. (Indiana)
Research Fellowship

C. J. BONER
Battenfeld Grease & Oil Corp.
Procurement of Technical Papers

G. ENTWISTLE
Sinclair Refining Co.
Editorial Review

W. J. EWBANK
Cato Oil and Grease Co.
Test Methods and Definitions of Terms

G. KAUFMAN
The Texas Company
Delivery Characteristics of Dispensing Equipment

H. C. ZWEIFEL
Richfield Oil Company
Classification of Lubricating Grease

"In 14 months...not a single bearing lubrication failure with lithium-base grease!"

Conveyor-stacker handling moist, sticky material which builds up on the rollers.

Ore unloading conveyor rollers handling 200 tons of ore per hour.

Pinion gear transmitting power from 600 h.p. motor to a ball mill.

Pan Conveyor handling hot clinker (1600°F), roller bearings in dusty, moist atmosphere.

Leach tanks handling hot slurry, agitators driven by Falk gear reducing units.

V.A. Wemco classifier, part of wet grinding system, lower bearing submerged in hot sludge.

THE PROOF IS IN THE PERFORMANCE...

lithium-base grease does the job...

and does it better!

Here's a report of our own experience with lithium-base grease under extreme industrial service conditions. Approximately 95% of the grease used in the plant of AMERICAN LITHIUM CHEMICALS, Inc., our subsidiary at San Antonio, Texas, is lithium-base, one-type grease. In fourteen months operation we have not been able to trace a single cause for bearing failure to the lubricant used. The on-the-spot photos above give graphic evidence of the rugged bearing service requirements in this plant where lithium ores are processed into high-grade lithium hydroxide, itself an important ingredient in lithium-base grease. Performance like this is why grease chemists, manufacturers, marketers and users all attest to the superiority of lithium-base... the *one* grease in place of *many* for efficient and economical operation.

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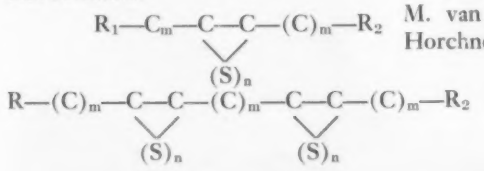
Patents and Developments

Extreme Pressure Grease

U. S. Patent No. 2,793,999 issued to W. Dietrich, Hans-Joachim Mertens and Fritz Wetter, assigned to Chemische Werke Huls Akt. Lubricants such as semi-solid or solid greases are imparted extreme pressure lubricating properties by incorporation therein of 0.05 to 1% by weight of a nitro compound such as m-dinitrobenzol, nitroparaffin or nitronaphthol and 0.5 to 10% of a sulfurized low molecular weight aromatic substituted olefine such as one having one of the general formulas:



where R_1 stands for an aryl or aralkyl residue, R_2 stands for hydrogen or an aryl, aralkyl or heterocyclic residue, m is 0, 1 or 2, and n is 1 or 2. Such a material may be prepared by heating a mixture consisting of a low molecular weight olefine containing an aromatic residue (e.g. styrene) and sulfur in the molecular proportions of about 1:1 at elevated temperature (150°--200°C) for 10-15 hours.

Basic Polyvalent Metal Salts of Organic Sulfonic Acids

U. S. Patent 2,794,829 issued to M. van der Waarden and J. M. Horchner, assigned to Shell Development company. Highly basic alkaline earth metal salts of alkylated aromatic sulfonic acids suitable for use in lubricating greases are prepared by reacting a polyvalent metal organic sulfonate (e.g., monoalkyl naphthalene sulfonates) of relatively lower basicity with an inorganic polyvalent metal salt and with an alkali metal hydroxide in presence of an aliphatic alcohol of from 1 to 3 carbon atoms. The polyvalent metal organic sulfonate (1-10%) together with an inorganic salt of the corresponding polyvalent metal (e.g., calcium chloride or bromide), is dissolved in a solvent comprising at least 25%-50% by weight of the alcohol (e.g., isopropanol). Water or up to 70% by weight of hydrocarbon (e.g., gasoline fraction) may be used with the alcohol. A solution of alkali metal hydroxide (0.5-5N KOH), with or without alcohol, then is gradually

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added to the alcoholic solution, while stirring. The hydroxide of the polyvalent metal is formed and it combines with the sulfonate starting material to form the desired basic sulfonate which is recovered by extraction with hydrocarbons such as those having 10 or less carbon atoms.

Synthetic Lubricating Composition

U. S. Patent 2,796,441 issued to J. K. Mertzweiller, assigned to Esso Research and Engineering company. Formals, ethers and esters derived from the Oxo process are used as the lubricating oils in greases highly suitable for extremely low and high temperature uses. The formal lubricants are produced by reacting (1) a crude alcohol mixture obtained by reacting a mixture of C_{12}-C_{18} olefins with CO and hydrogen, thereby obtaining a mixture of products which is then further hydrogenated to form the crude alcohol mixture, and (2) a formaldehyde donor (formaldehyde, paraformaldehyde, formalin, etc.), at 150°300°F. in presence of an acidic catalyst and stripping the mixture of products to vapor temperatures equivalent to 650°-750°F.

Formals of Lubricating Grade in Greases

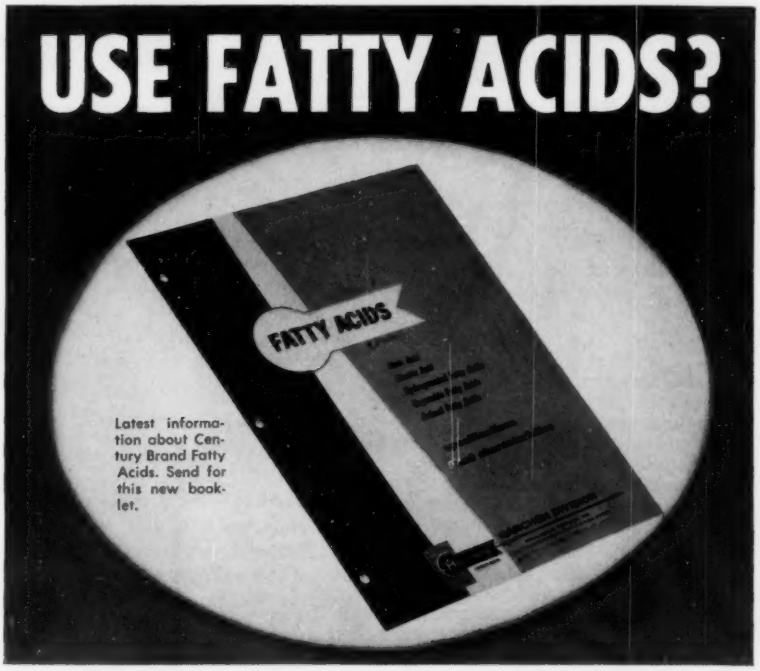
U. S. Patent 2,796,423 issued to D. L. Cottle and D. W. Young, assigned to Esso Research and Engineering company. Greases are produced with a formal of lubricating grade having outstanding low and high temperature properties. The formals have the general formula:

$$A–O–CH_2–O–B$$

wherein A and B represent radicals which are organic hydroxy compounds less the reacting hydrogen atoms, and they may have 1-60 carbon atoms. An example of such a grease is a composition containing 7.5% lithium stearate, 7.5% lithium hydroxy stearate, 0.5% phenothiazine and 84.5% of a formal of C_{10} Oxo alcohol.

Complex Formal Lubricating Composition

U. S. Patent 2,796,401 issued to A. H. Matuszak, W. E. McTurk, D. L. Cottle and D. W. Young, assigned to Esso Research and Engineering company. Greases are prepared with complex formal lubricating oils having at least one free hydroxyl group which is alcoholic in nature, and which contains a $-O[-CH_2-O(C_nH_{2n}O)_y]_xCH_2-O-$ linkage, x and n being 2 or more, and y being 1 or more. Such oils are claimed to withstand high and low temperatures, thus making the greases suitable for jet engine use. An example of such a grease is one containing 20% lithium fatty acid soaps (Litholite A), 1% phenyl alpha-naphthylamine, and 79% of a complex formal, i.e., C_{13} Oxo $-(CH_2O-$Tripropylene glycols$)_3-CH_2O-C_{13}$ Oxo alcohol. ■



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It is currently in use or under test in the following three areas: 1) Synthetic greases for spec. Mil-G-3278-A Low Temperature Aircraft Grease; 2) Low-cost blending component for synthetic low-temperature lubricating fluids meeting Mil-L-7808 C; and 3) synthetic lubricant base fluid for civilian lubricants in aircraft, automotive and specialty uses.

Since 3033-S is based on a relatively low-cost acid, pelargonic acid, long-range economics are favorable. Also, availability is not contingent on strategic, imported raw materials since pelargonic acid is made from abundantly available domestic fats and oils.

Though 3033-S is in a development stage, it is available in tankcar quantities on reasonable notice.

Mail coupon below for Technical Bulletin titled "Emery 3033-S Lubricant Ester" for complete characteristics and performance data in synthetic greases and fluids.

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Cincinnati 2, Ohio
Please send Development Product Bulletin #60 on Emery 3033-S.

Name.....
Company.....
Address.....
City.....State.....

Emery

Development and Service Department
Emery Industries, Inc.
Carew Tower, Cincinnati 2, Ohio

Emery Promotes Eden to Market Development Staff

Frank E. Eden has been promoted to the staff of the development and service department of Emery Industries, Inc., W. T. Meinert, director of development and service, announced.

Eden will be concerned with the market development of new chemical products, as well as with technical service for Emery's lines of fatty acids, fatty esters, organic acids, lubricant esters, and plasticizers.

On Laboratory Control Staff

Eden has been a member of Emery's control laboratory staff since 1953. He holds the degrees of Bachelor of Science in Chemistry and Bachelor of Laws from the University of Cincinnati and Master of Business Administration from Xavier University. He is a member of the Ohio Bar Association.

Climax Announces Executive Appointments, New Chemical Group

Gay V. Land has been appointed vice president, oil department of the Climax Molybdenum company, it was announced by Arthur H. Bunker, president of the company.

Oil Operations Begun in 1950

Mr. Land has been associated with Climax's oil operations from their inception in 1950 and during the past three years he has been manager of the oil department. During this time, this phase of its business has become increasingly important. The company now has oil and gas properties in the United States, Canada and the Gulf Coast offshore areas.

Mr. Land received his BS in Chemical Engineering from the Massachusetts Institute of Technology in 1944 and his MS in Industrial Management from the Wharton graduate school at the University of Pennsylvania in 1950.

Prior to joining Climax, Mr. Land worked for Carbide and Carbon Chemical corporation on the Atomic Energy Project in Oak Ridge, Tennessee, and subsequently for the Socony-Mobil Oil Company, Inc.

MacGregor Is Vice President of Eastern Operations

MacGregor Innes

Ian K. MacGregor has joined the Climax Molybdenum company as vice president—eastern operations, it was announced by Arthur H. Bunker, president of the company.

Mr. MacGregor had been general manager of Manning, Maxwell and Moore, Inc. of Stratford, Connecticut, manufacturers of valves and instruments, since 1952. Previously he had been with Campbell, Wyant and Cannon Foundry company of Muskegon, Michigan.

MacGregor was educated in Glasgow, Scotland, receiving his BS in Metallurgical Engineering from the University of Glasgow in

Continued on page 32

Use the Advantages of the Emolein® Azelates and Pelargonates to Capture Your Share

The new passenger jet air age, depicted by the Boeing 707, will soon require substantial quantities of synthetic lubricants. By basing them on the Emolein Azelates, already proven in military applications, you get the advantages of a combination of many desirable features including 1) extreme heat and cold performance 2) uniform temperature-viscosity performance, high viscosity index, 3) low pour point, 4) excellent lubricity, 5) stability to corrosion and oxidation, 6) high flash and fire points and 7) excellent additive response.

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1935. He also attended the Royal College of Science and Technology and was elected an associate.

During the war MacGregor was a member of the British tank mission to the United States and later was associated with United States Army Ordnance in connection with the production of armor plate and other ordnance material.

Innes Heads New Chemical Group

Chemical sales and development activities, formerly separate functions, have been consolidated for more effective sales effort, under a recent reorganization of the Molybdenum chemical activities. Reuel E. Warriner, vice president–sales for the Climax Molybdenum company, announced the appointment of George L. Innes to head these activities.

Mr. Innes joined the Climax organization in 1955 as manager of chemical sales. Prior to this time he was sales manager of the Jefferson Chemical company. He received his AB in Chemistry from Harvard University in 1938, and presently makes his home in Bronxville, New York.

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H. B. Miller Leaves API; Joins Pan American Airways

The resignation of Rear Admiral H. B. Miller, USN (Ret.), from the American Petroleum Institute, effective August 31, was announced by Frank M. Porter, president. On September 1 Miller will assume the duties of director of public relations of Pan American World Airways.

Philip C. Humphrey has been designated as acting director of the Department of Information of the American Petroleum Institute and acting executive director of the Oil Information Committee, effective September 1.

Raborn Becomes Kerr-McGee Secretary-Treasurer

Hubert H. Raborn has been elected secretary and treasurer of Kerr-McGee Oil Industries, Inc., Oklahoma City. He has been vice president and secretary of Triangle Refineries, Inc., of Houston, Texas, a company acquired by Kerr-McGee this spring, and operated as a separate subsidiary. Raborn will continue in his position with Triangle.

Three men will serve as assistant secretaries and assistant treasurers of Kerr-McGee:

S. B. Robinson, who has served as assistant secretary and assistant treasurer of the company since 1951;

W. O. Holdren, formerly assistant secretary and assistant treasurer of the Deep Rock Oil company, a subsidiary absorbed by Kerr-McGee in May, 1956, and

J. H. Lollar, Jr., formerly secretary and treasurer of Kerr-McGee, since July 1 treasurer of Triangle Refineries, Inc.

A native of Montague county, Texas, Raborn attended high school at El Dorado, Arkansas. He finished his accounting education at St. Louis University in 1945, and was accredited as a certified public accountant by the state of Missouri in 1946. The new secretary and treasurer, was manager of the Houston office of the accounting firm of Touche, Niven, Bailey & Smart for three years before joining Triangle in 1950 as vice president and secretary.

Marzke Receives U. S. Steel Vice Presidency

Dr. Oscar T. Marzke has been appointed vice president–fundamental research of United States Steel corporation, effective September 1, it was announced by James B. Austin, vice president, research and technology.

Dr. Marzke, who is now director of research, U. S. Naval research laboratory, was formerly associated with U. S. Steel in the research department of American Steel & Wire division.

Born in Lansing, Michigan, Dr. Marzke was graduated from Michigan State college with a B.S. degree in 1929. He received his doctor of science degree in metallurgy from Massachusetts Institute of Technology in 1932. His first employment with U. S. Steel was as assistant director of American Steel & Wire's research laboratory in Worcester, Mass., in 1934. He was made assistant district metallurgist in Worcester in 1938 and works metallurgist of North Works in 1940. He was transferred as works metallurgist to Waukegan Works in 1942.

Joined Naval Research in 1946

Joining Navy research in 1946, Dr. Marzke was made superintendent, metallurgy division of the U. S. Naval research laboratory. He was made associate director of research in 1954 and director of research in 1956.

Continued on page 34

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Marzke—U. S. Steel

Continued from page 32

A member of a number of technical societies, Dr. Marzke is vice chairman, Institute of Metals Division, American Institute of Mining, Metallurgical and Petroleum Engineers, and has been Naval liaison member, Materials Advisory Board, National Research Council since 1952. Also he is a member of the American Society for Metals, British Institute of Metals, British Iron & Steel Institute, and the Research Society of America.

Wilkes Joins OIC Editorial Staff

Stuart Wilkes, former managing editor of the *Oil Daily*, Chicago, has joined the editorial staff of the Oil Information Committee of the American Petroleum Institute in New York, it was announced by H. B. Miller, the committee's executive director.

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Wilkes started his business career in 1945 as reporter, and then assistant petroleum department editor, of the Chicago *Journal of Commerce*, which subsequently became the Midwest edition of the *Wall Street Journal*. He resigned in 1951 to help in the formation of the *Oil Daily*, national petroleum trade newspaper. There his duties included assigning, gathering, and editing of news; layout and story treatment, and supervision of production.

Wilkes was born in Chicago in 1914, is married and has two children. He is a graduate of Culver Military Academy, the University of Illinois, and Bryan and Stratton Business college.

Alemite Sales Planning Post to Bester

Bob Bester has been named to the newly-created post of sales planning and merchandising manager of the new line of Alemite-Surgepruf hydraulic hose assembly and couplings, Thomas M. Murphy, Alemite industrial sales manager has announced.

Until recently, Bester has been factory sales representative for Anchor Coupling Co., Inc.

Bester's long experience in calling on major accounts in the oil hydraulic field equips him particularly well for his new position, Murphy stated.

Prior to his association with Anchor, Bester had been assistant to the sales manager of Steel Improvement and Forge Co., Cleveland, and had also served as quotation manager of the Insulation Manufacturing Co., also of Cleveland.

Bester attended Western Reserve university and is a member of the Society of Automotive Engineers.

Alemite is a division of Stewart-Warner corporation.

Wilding Joins Staff Of ASME

Appointment of John D. Wilding to the post of assistant secretary of the American Society of Mechanical Engineers has been announced by William F. Ryan, president of the 50,000 member engineering group.

Mr. Wilding, a member of the ASME staff since 1954, will be in charge of the society's Codes and Standards service, which coordinates the activities of more than seventy-five committees under ASME sponsorship engaged in preparing and revising codes and standards dealing with mechanical equipment of many kinds, including boilers, elevators, screws and other items. He is a graduate of the Pennsylvania State university, where he received a Bachelor of Science degree in electrical engineering. Before joining the staff of ASME, he was a project engineer with M. H. Kellogg company and served as a captain in the Signal Corps during World War II. He now makes his home in Keyport, New Jersey.

Rost Joins Franklin Sales Force

The Franklin Oil & Gas company, Bedford, Ohio has announced that Edward J. Rost has joined their sales force as lubrication engineer.

Rost has been associated with the oil industry in a sales capacity for the past seven years. In his new position he will continue to call on industrial concerns in the Northeastern Ohio area. Rost has been active in the American Society of Lubrication Engineers and is just completing his term as chairman of the Cleveland chapter.

Franklin has been serving industry since 1903 and is a major producer of rust preventive compounds for the armed forces. The company recently announced the development of a new type fire re-

tardant hydraulic fluid for use in machine tools located in areas where fire hazards pevail.

Shell Marketing Changes Told

J. G. Jordan, Shell Oil Company's marketing vice president, announced three staff changes in the firm's marketing organization.

S. Goldin, assistant to the general manager of Shell's head office marketing departments, will succeed P. W. Engels as manager of marketing operations when Mr. Engels retires in mid-1958.

R. L. Geraghty, manager of the marketing administrative office, will succeed Mr. Goldin as administrative assistant to the general manager. The two divisions of the former administrative office will continue to report to Mr. Geraghty.

Goldin is a native of Atlanta, Georgia. He received his B.S. in Chemical Engineering from Georgia Tech before joining Shell in 1930 as a student salesman in Wood River, Ill. He later served as a division retail manager in Jacksonville, Florida, retail sales manager in Atlanta, Ga., and assistant division manager in Jackson Heights, New York. In 1947, he was named manager of the asphalt department in New York. In 1947, he was named manager of the asphalt department in New York. He was promoted to his present position in 1956.

Geraghty Joined Shell in 1920

Geraghty was born in Rushville, Indiana. He joined Shell as a sales clerk in Indianapolis in 1926. He was made office manager of the marketing service department in Detroit in 1934. In 1946, he was named manager of the marketing service department in New York. He has held his present position since 1952.

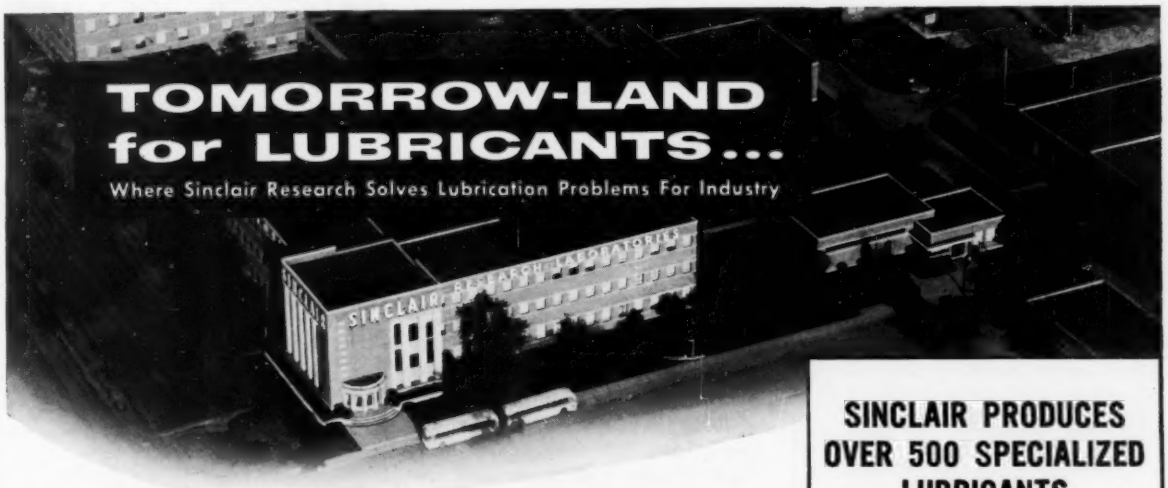
Engels joined Shell in 1922 as a clerk in the St. Louis office, and was named plant manager there nine years later. In 1945, he was named manager of marketing operations in New York. He has been in his present position since 1954.

Fox to Manage Socony Asphalt Department

LeRoy B. Fox, manager of the fuel oil division of the gasoline and fuel oil department, Socony Mobil Oil company, Inc., since January, 1946, has been appointed manager of the asphalt department. He succeeds George R. Christie, who joined the company 41 years ago and was manager of the asphalt department for nineteen years. Mr. Christie will retire soon under the company's annuity plan.

Succeeding Mr. Fox is Leonard S. Marshman, who had been manager of the crude oil division of the distribution department of Mobil Overseas Oil company.

News continued next page



Located at Harvey, Illinois, is one of the most extensive installations of its kind in the world—Sinclair Research Laboratories. These facilities are an important part of Sinclair's investment in the future. Here is where Sinclair engineers and chemists work to develop new products and improve the quality of existing ones. At these famous laboratories were developed the Sinclair lubricants now solving difficult problems in all branches of industry. If you have a special lubrication problem, write today to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y.

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Industry News

Wright Air Development Orders Lithium Comprehensive from ALI

The materials laboratory of the Air Research and Development command's Wright Air Development Center has named the American Lithium Institute as the contractor to prepare a comprehensive handbook on lithium and its compounds.

In preparing the handbook, the Institute will investigate, analyze and consolidate detailed data on the physical, mechanical and chemical properties of lithium and its compounds. In the investigative phase of the project, all pertinent existing data on lithium will be extracted and catalogued together with source references. The analytical phase will be a critical examination of the collected data—as to its scientific validity, reliability and errors—while the consolidation phase will consist of a compilation and presentation of the facts. Marshall Sittig, president and managing director of the American Lithium Institute, will be responsible for carrying out each of these phases and will work in close cooperation with personnel in the materials laboratory.

The American Lithium Institute, a non-profit organization, was formed earlier this year to broaden the present markets for lithium and lithium compounds and develop new markets through the sponsorship of research and the dissemination of information.

New Multi-Purpose Gear Lubricant on Market

Approval of a new designation, "Multipurpose-Type Gear Lubricant (A.P.I. Service GL4)," to define the new higher performance multipurpose gear lubricants now being placed on the market was announced by the American Petroleum Institute.

The designation has been approved by the division's lubrication and general committees, and has been reported to the Society of Automotive Engineers. It was designed to meet the automotive industry's requirement for a designation and definition significantly different from current ones, to assure that the new lubricants would be furnished when called for in car owners' instruction manuals.

The definition to accompany the new designation is as follows:

"This term designates lubricants which have adequate load carrying ability and other required properties to protect hypoid gears in sustained high speed and/or high torque service in modern high powered passenger cars and trucks. These lubricants are also suitable for use in spiral bevel gears, many transmissions, and worm gears in some types of service. Such lubricants are identified as meeting 'A. P. I. Service GL4.'"

All Teflon Sealed Bearing Is Fluid Resistant

Revolutionary design innovations by Miller fluid power division of Flick-Reedy corporation have made possible the introduction of the first all-Teflon sealed cylinder with universal resistance to fluids.

Frank Flick, president of the Melrose Park. Ill., firm said the design changes, which include a unique end seal to strengthen the cylinder's weakest link, will also enable the firm to:

1. Up pressure ratings on its entire line of high pressure hydraulic cylinders.

2. Introduce a completely new

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line of medium to high pressure hydraulic cylinders.

"Industry leaders have been predicting that the all-Teflon cylinder was at least five years away," Flick said. "Our design department thought they saw a way—and came up with what we feel are the most significant developments in the past decade."

Simpler servicing through elimination of the possibility of shearing is another advantage resulting from the seal design developments, Flick said. These new features include a unique tubing end seal and a new piston rod bushing seal which permit use of Teflon sealing rings instead of the synthetic rubber "O" rings previously used.

In addition, a new cushion adjusting screw with a self regulating Teflon lock seal, is being introduced. Located in the head or cap end, the adjusting screw is now directly opposite the ball check, also re-designed, and is interchangeable with it.

The all-Teflon cylinder, new pressure ratings, and LH line will be available after August 1. Manufacturing economics have offset the increased cost of added Teflon seals, and the former price list will be maintained, Flick said. As before, Teflon piston cups will be available at extra cost.

Longer Life for Seal

Flick said the "all-Teflon" cylinder will mean longer seal life and will free users from the fluid and temperature limitations of leather, synthetic rubber and composition sealing materials previously used. With Teflon, seals no longer need to be changed when different fluids are introduced or high temperatures encountered, since the milk-white plastic is inert to virtually all fluids, including non-flammable fluids and is resistant to temperatures up to 500° F.

New Grease Additive Oronite GA-10 Greatly Improves Lubricant

Oronite GA-10*, a new synthetic gelling agent for industrial greases, makes possible the formulation of superior multipurpose and specialized grease lubricants that outperform the best of conventional greases, according to M. L. Baker, Oronite Chemical company vice president. GA-10, a derivative of the fiber ingredient, terephthalic acid, was first developed by Oronite's research affiliate, California Research corporation, to meet the demand for grease lubricants that would stand up under the extreme temperatures, high loads, and high speeds of modern machinery. Greases normally made with the sodium salt of the new GA-10 show remarkable heat stability, water resistence, work stability and bearing performance.

Compared to sodium stearate

greases which have a dropping point between 375°F. and 425°F., sodium GA-10 greases maintain their structure up to 600°F. GA-10 grease showed no emulsification after a week in a boiling water test, whereas sodium stearate greases disintegrate in 4-5 minutes. Where water resistant grease lubricants are required, such as in mining machinery, wheel bearings of mine locomotives, materials handling equipment and construction machinery, the long life of GA-10 grease has reduced lubrication down-time as much as 95 per cent, a significant saving in maintenance labor and grease cost.

Where grease lubricants are subjected to severe grinding between metal surfaces as in rolling contact bearings, they suffer loss of gel structure. After 1000 hours in the severe Roll Test where a heavy roller grinds greases in a cylinder rotating at 175 rpm, two of the best soap-gelled greases softened 39% and 69%; a typical sodium GA-10 grease softened only 25% indicating its superior work stability.

Rigid Tests for GA-10

In wheel bearing tests where GA-10 greases were subjected to extreme temperatures as well as cold running conditions for 19 hour periods, they showed excellent stability and even distribution, with a good reservoir of grease on each retainer to feed onto rollers.

According to Oronite experts, in automatic feeding systems or in pressure guns the fine texture and high gelling power of sodium GA-10 allow greases to outperform comparable soap-gelled greases of essentially the same consistency.

GA-10 greases have exceptionally high tolerances for other types of greases. They are compatible with mixtures of sodium soap and lithium hydroxystearate greases. Normally, mixtures of soap-thickened greases have lower dropping points and bearing performance than either of the individual greases. Mixtures with GA-10 greases show no such degradation. The exceptionally high dropping point of GA-10 greases further protects them against contaminative failure.

Cost Savings Big Feature

Buyers of grease lubricants will be particularly interested in cost savings made possible with GA-10 greases. Lubricants made with GA-10 last 2-3 times longer than conventional greases and it can take the place of several specialized greases thus effecting further economies, Oronite men say.

Oronite Chemical has opened a new district sales office in Wilmington, Delaware. Located in the Delaware Trust building, the new district office is in line with the company's plan to expand sales and marketing activities throughout the Southeastern United States. B. W. Colaianni, recently promoted to district sales manager, will head up the southeastern district sales office for Oronite.

*Patents pending.

American Lithium Institute Sponsors Research On Polymerization

The American Lithium Institute, in an effort to amass new technical information on the role of lithium and its compaunds in polymerization reactions, will sponsor a research program for this purpose at Princeton University. The project will be under the direction of Professor Arthur V. Tobolsky, department of chemistry, who is well-known in the field of polymer research.

Aid to Graduates

Professor Tobolsky said that this project is welcome at Princeton as an aid to graduate education in chemistry through the promotion

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Harshaw Lead Base, as an additive to petroleum lubricants, improves extreme pressure characteristics and imparts the following desirable properties:

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of scholarship and research. He expressed the hope that it would extend scientific knowledge in the field of polymerization using lithium and lithium compounds as catalysts.

Lithium and its compounds will be used experimentally as initiators and modifiers in vinyl polymerization and copolymerization. An intensive study will be made of the rates, molecular weights, and copolymer compositions of these materials.

Valvoline Begins Distribution of New Automotive Chart

Distribution has begun by the Valvoline Oil company, Freedom, Pennsylvania, of their new combined calendar and automotive lubrication chart. All domestic models are included with a section for foreign cars distributed in the United States. Valvoline is a division of Ashland Oil and Refining company, Ashland, Kentucky.

Socony Mobil's Technical Lab Receives Award

TOP safety award goes to Socony's Brooklyn technical service laboratory. W. Brown of New York Safety Council makes award to T. G. Roehner, center left.

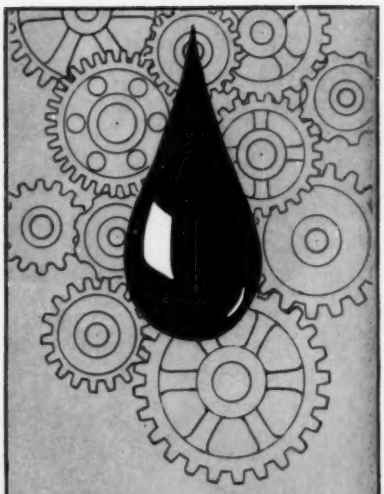
It would take one man 1,500 years of safety on the job to equal the safety record set by the 230 employees of Socony Mobil's Brooklyn technical service laboratory. These oil company people have just completed 3,000,000 man-hours without loss of a single day's work because of injury on the job.

The achievement, for which the laboratory has received the National Safety Council's highest "honor award," was accomplished over a period of nearly seven years through a vigorous safety program.

"Of the many thousands of laboratories, plants and other installations in the oil industry, only about a dozen receive the honor award each year," said William F. Brown (center, right) of the Greater New York Safety Council in making the presentation to T. G. Roehner, head of the laboratory. (Editor's note: Roehner is chairman of the NLGI Technical Committee). Others in the photograph left to right are: V. Malone, safety coordinator of the lab, J. Herbert, safety director for Socony Mobil, lab nurse D. Krieger, D. Clewell, general manager, Socony Mobil research department, Roehner, Brown, O. Buckholz, E. Young, F. McCabe, and G. Mapes, members of the safety committee at the lab.

The achievement was particularly significant because of the nature of the laboratory's work. Many of the gases, chemicals and fuels used in tests and experiments there are highly volatile. In addition, the laboratory frequently employs radioactive materials like "Cobalt 60."

News continued next page



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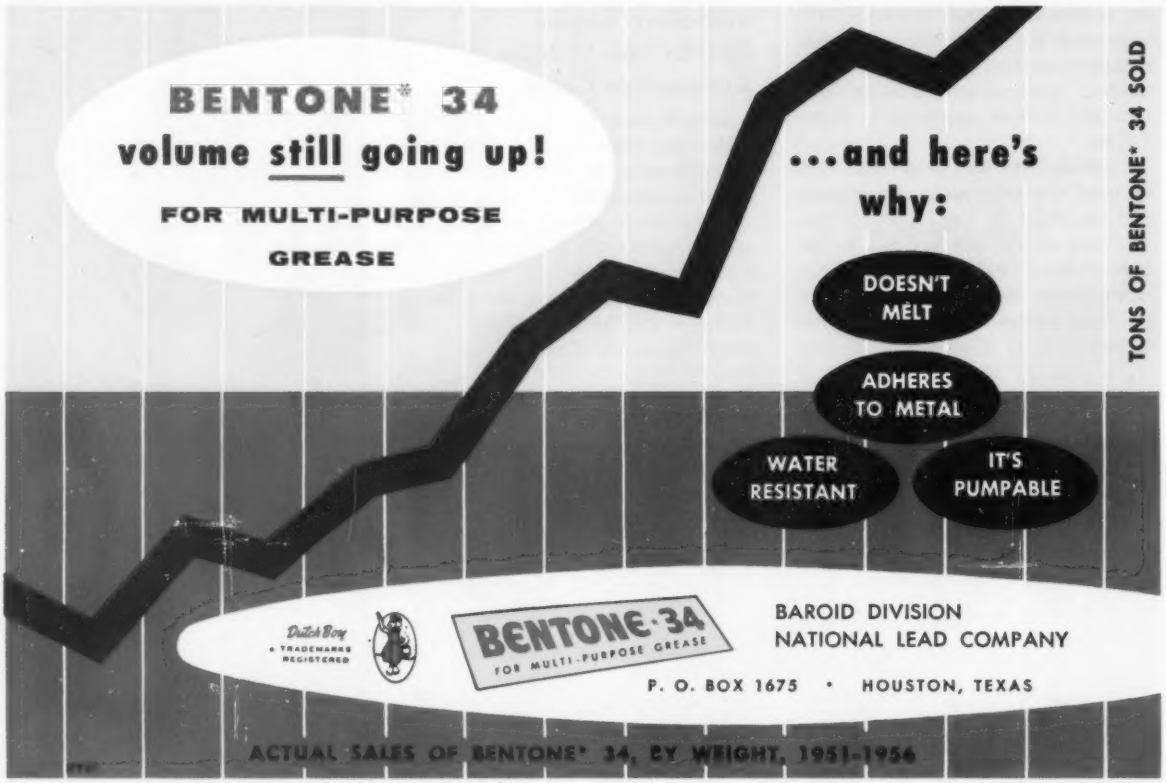

New Manual on Synthetic Lubricants Released by Lehigh Chemical Company

"Jet Age Lubricants" . . . a manual on the development, testing and application of engineered lubricants has recently been released by Lehigh Chemical company, Chestertown, Maryland.

This 24-page, fully-illustrated brochure brings into focus the history of synthetic lubricants—products of the jet age requirements for lubricants with physical properties superior to those attainable with ordinary petroleum products. Lehigh Chemical company's pioneering efforts in this field are outlined, along with the outstanding record that their synthetic lubricants set in World War II, the Korean conflict, and the present day military and industrial applications—including the lubrication of the earth sattelite.

The unique testing operations that Lehigh's laboratory conducts are illustrated and described in detail. Charts and graphs are used to demonstrate the physical properties of Anderol lubricants in comparison with petroleum lubricants in such important factors as volatility, oxidation stability, evaporation, etc. These tests and graphs are handled in a manner to make them interesting and informative to the layman as well as the technical specialist.

Special Military Spec. Section

"Jet Age Lubricants" contains a section devoted to *Military Specifications and Their Significance*. In this section, a complete listing is given of all the applicable military specifications in Lehigh's field and the corresponding Anderol products that meet these specifications. And, for the industrial user, the book contains a special listing of Anderol industrial products—including oils, greases, damping fluids, preservatives, etc.

Anyone interested in the new field of synthetic lubrication—and the outstanding new developments coming out of the research chemist's laboratory—will find "Jet Age Lubrication" a source of up-to-date information and product data. For your copy, write to: "Jet Age Lubrication," c/o Industrial Service Department, Lehigh Chemical Company, Chestertown, Maryland.

New Warehouse Completed For Du Pont Petrochemicals

New warehouse facilities have been established by Du Pont's petroleum chemicals division at Mt. Vernon, Wash., to provide faster, better service to users of its petroleum additives in the rapidly expanding petroleum industry of the Pacific Northwest.

All types of Du Pont's gasoline

dyes, gasoline anti-oxidants, metal deactivators, fuel oil additives, and grease anti-oxidants will be stocked at the new facilities, which supplement those already in operation at Los Angeles, Chicago, Kansas City, Mo., Houston, Texas, and Billings, Mont. Tetraethyl lead, used as an antiknock additive in gasolines, will continue to be warehoused for the West Coast in Los Angeles, with specialized service to Northwest refineries from the company's tank car "warehouse on wheels" at Ferndale, Wash.

"Aquadag" Aids in Lighting Needs

Ideal Lighting company, Kenosha, Wisconsin, manufacturer of "Grid-Lite" fluorescent lamps, has found colloidal graphite an ideal parting agent in the fusing of glass housings for the lamp's cold cathode electrode assemblies.

In shaping the glass housing it is necessary to leave an opening in the outer end so that, after the electrode assemblies have been inserted and the housing fused to the tube, air and absorbed gases can be evacuated from the tube's interior surface prior to sealing. To retain this opening in the housing, small diameter brass rods are dipped in a solution of "Aquadag", a dispersion of colloidal graphite in water manufactured by Acheson Colloids company, Port Huron, Michigan, a division of Acheson Industries, Inc. The coated rods are then sealed in the outer end of the housing. After the housing has been fused to the light tube, the rods are easily withdrawn, leaving a hole for the evacuation of the gases.

Ideal Lighting has always used "Aquadag" for this purpose. The company has found that the thin, dry film graphite has ideal adhering qualities which make it very suitable for applying by means of a quick dip. And, in the heat of fusion, "Aquadag" neither burns off nor chemically affects the glass.

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Venatta to Manage Oronite Oak Point Plant

The promotion of W. K. Venatta to manager of Oronite Chemical company's Oak Point, La., plant was announced by T. G. Hughes, president, Oronite Chemical company. He succeeds T. I. Clausen, who is being transferred to California Research corporation. In his new assignment Mr. Venatta will be responsible for the expanding manufacturing, distribution and purchasing operations in connection with the production of lube oil additives, gas odorants, dispersants and other products of the Oak Point, Louisiana, facility.

Mr. Venatta, who received a B.S. degree in Chemical Engineering from the University of Wisconsin, began his career with California Research corporation in 1939. In 1948, shortly after the Oronite Chemical company was formed, he was appointed manager, product control for Oronite. His responsibilities in this position were later expanded to include direction of world-wide distribution of Oronite products.

New Fire Protection Standard Achieved

A new NFPA standard on procedures for cleaning or safeguarding small tanks and containers prior to making repairs, NFPA No. 327, has just been released by the National Fire Protection Association.

This standard is new in its field and represents authoritative information as to best methods of avoiding fires and explosions when weld-

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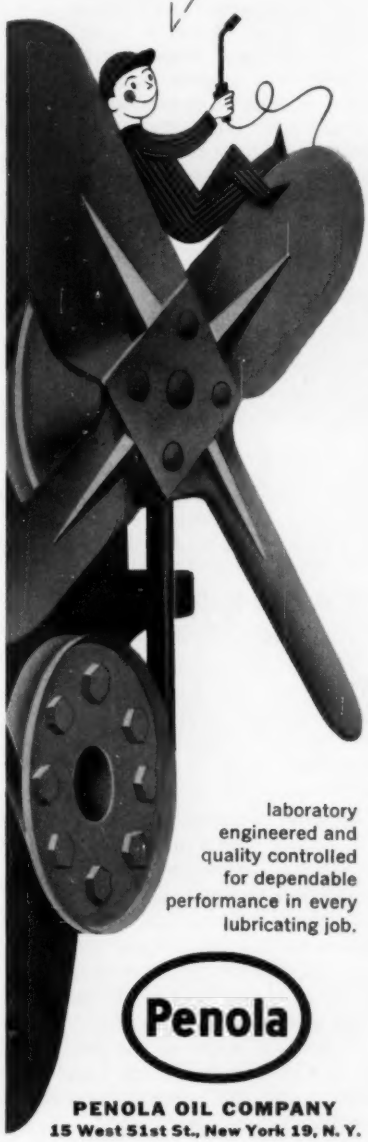

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ing or doing other work on small containers. It is the result of the deliberation of several committees over a period of several years.

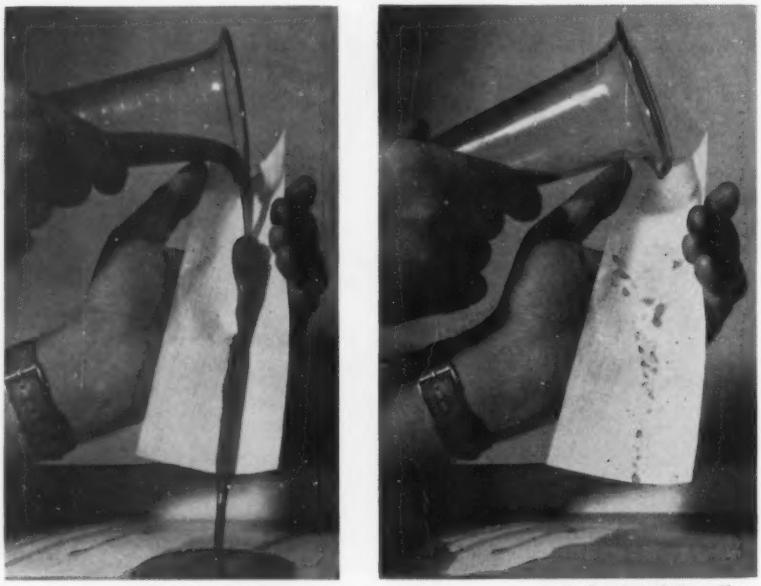
IOCA Will Hold Tenth Annual Meeting

The tenth anniversary annual meeting of the Independent Oil Compounders Association will be held at the Pick-Carter hotel in Cleveland, from September 22-24, 1957.

Material presented at the session will include papers on greater usage of drums, maintaining customer satisfaction through adequate service, sales fundamentals, facts and figures from a used motor oil survey, and the development and application of a broad performance range gear lubricant additive.

In the final stages of the meeting the IOCA members will make a plant visit of the Lubrizol corporation facilities in Cleveland.

Agricultural Department Develops Oil-Resistant Cotton



Authenticated News Photo

A photographic example of what it would mean if grease rolled off clothing leaving no greasy stains now so hard to remove.

The development of a treatment to render cotton oil-resistant is one of the projects now underway at the Southern Utilization Research and Development Division, Agricultural Division, Agricultural Research Service, U. S. Department of Agriculture, New Orleans, La. This is in conformance with the program of research of the department to find new and improved uses for agriculturally produced commodities. The project was undertaken to determine if the properties of grease, oil and water repellency could be imparted to cotton through chemical means, and thus permit cotton to compete more successfully with synthetics having these characteristics. The pictures show laboratory produced materials. The treatments are still under study and therefore materials so treated are not available commercially. One of the most promising treatments has been applied to the fabric in the illustration. The address in New Orleans is 1100 Robert E. Lee Boulevard.

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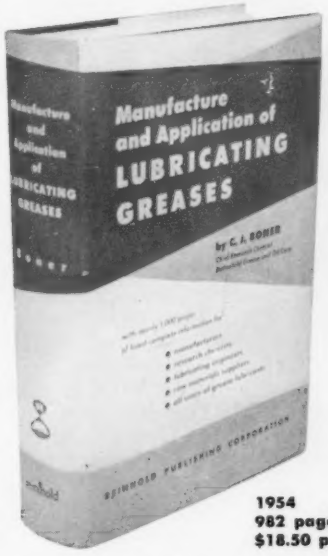
by C. J. Boner

Chief Research Chemist
Battenfeld Grease and Oil Corp.



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3 Additives Other Than Structural Modifiers
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5 Manufacturing Processes
6 Equipment for Lubricating Grease Manufacture
7 Aluminum Base Lubricating Greases
8 Barium Base Lubricating Greases
9 Calcium Base Lubricating Greases
10 Lithium Base Lubricating Greases
11 Sodium Base Lubricating Greases
12 Lead Soap Lubricating Greases
13 Strontium Base Lubricating Greases
14 Miscellaneous Metal Soaps as Components of Lubricating Greases
15 Mixed Base Lubricating Greases
16 Complex Soap Lubricating Greases
17 Non-Soap Thickeners for Lubricating Fluids
18 Fillers in Lubricating Greases and Solid Lubricants
19 Residua and Petrolatums as Lubricants
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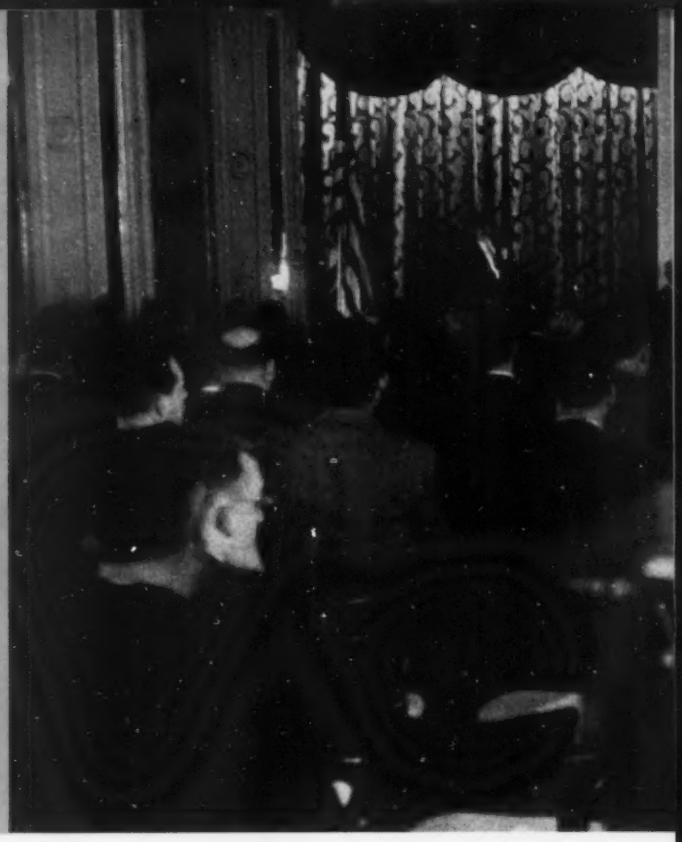
Previews... NLGI 25th ANNUAL MEETING



NLGI '57

THE BEGINNING OF NLGI's silver anniversary could not be acknowledged in finer fashion than with the excellent program tentatively scheduled below . . . sessions with experts discussing a number of subjects of particular interest to the lubricating grease industry. The 25th Annual Meeting will put particular emphasis on how users of heavy road building equipment can profit from proper lubricating grease programs, there will be a Technical Committee symposium entitled "Fundamental and Practical Aspects of Bleeding of Lubricating Greases," and special sales features in a concentration on marketing aspects. Each succeeding annual meeting has increased in scope and interest, size and representation . . . friends and members of NLGI are invited to use the reservation card enclosed in this issue for ease in obtaining hotel accommodations.

Life, Liberty and Property—Stary Gange, Keynote Speaker

Developments in Lithium Compounds—J. B. Milgram, Jr., W. F. Luckenbach and R. G. Verdieck. Foote Mineral Co.

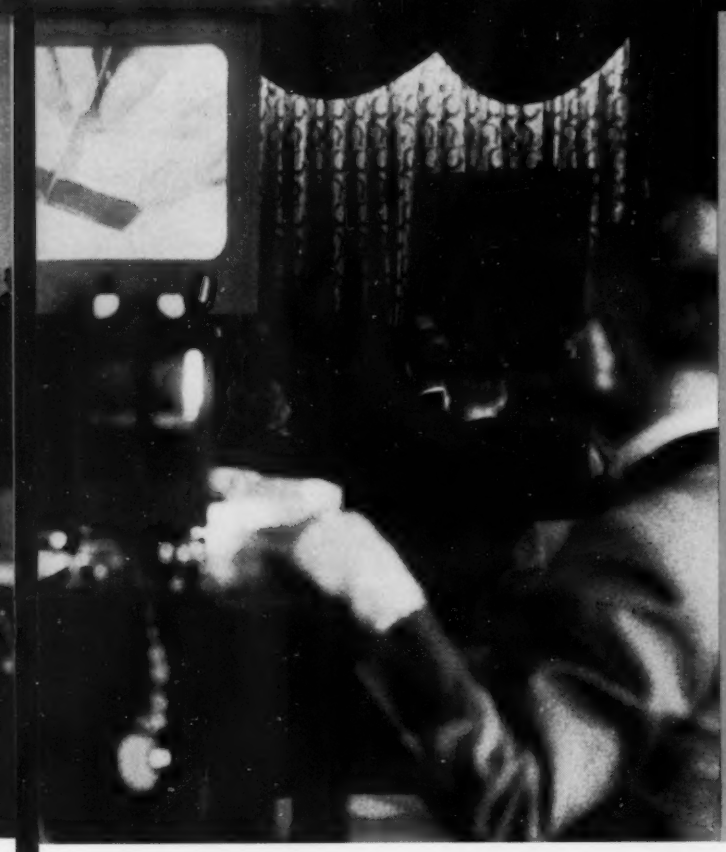
Development of an Extreme High Temperature Grease—J. W. Armstrong and H. A. Woods, Shell Oil Company

Selling the Magic Film Promotionally—H. A. Mayor, Jr., O. Elliott and J. R. Hodges, Southwest Grease & Oil Co., Inc.

Pyrogenic Silica Thickened Greases — P. B. Marsden, Godfrey L. Cabot, Inc.

A New Equation for Calculating Flow of Lubricating Greases—D. W. Criddle, California Research Corp.

Modern Methods of Lubricant Application—E. J. Gesdorf, Farval Corporation



At Chicago's EDGEWATER BEACH HOTEL OCTOBER 28-30

CRC Method of Test for Rust Preventive Properties of Lubricating Greases—E. W. Adams, Standard Oil (Indiana)

A Study of the Mixing Efficiency of Grease Kettles—E. O. Forster, A. Beerbower, J. J. Kolfenbach, H. G. Vesterdal, Esso Research & Engineering Co.

Packaging — An Essential Service — A. D. Murphy, Esso Standard Oil Co.

Lubrication of Contractors' Equipment (Panel Discussion)—G. W. Krause (Introduction), Battenfeld Grease & Oil Corp.

Earth Moving Equipment Must Pay Off—R. L. Nelson, S. J. Groves & Sons

Solving Lubricant Dispensing Problems—T. M. Murphy, Alemite Division, Stewart-Warner Corp.

Building the Construction Giants—G. K. Brower, International Harvester Co.

The Contractor's Partner—The Lubricant Supplier—D. Rosselle and R. J. Brossman, Standard Oil (Ohio)

Fundamental and Practical Aspects of Bleeding of Lubricating Greases (Symposium)—J. L. Dreher, California Research and M. J. Pohorilla, Kendall Refining, (Chairmen)

Summary of Study of Bleeding of Lubricating Greases—B. B. Farrington, California Research Corp. (Chairman)

Tensive Stresses on Lubricating Greases Reduce Bleeding—D. W. Criddle, California Research Corp.

Grease Bleeding—Cause and Effect—S. F. Calhoun, Rock Island Arsenal

Factors Affecting Bleeding and Separation Characteristics of Greases and their Evaluation—J. S. Aarons, National Tube Division of U. S. Steel Corp.

Long Time Bleeding Characteristics of Greases—A. E. Baker, General Electric Co.

News About NLGI

Distribution of Film Announced

The NLGI moving picture, "Grease–the Magic Film," a 16-mm, 25-minute sound movie in color, has been finished and distribution of prints has been made to those purchasers who placed firm orders prior to completion. Prices to Members are $600 for an initial copy, $400 for a second copy, and $200 for a third and any subsequent copies. Interested non-members may secure copies at rates $100 above the member cost in the quantity ranges shown.

Multi-lingual Voice Arrangements

Because of the interest evidenced in using the film in foreign areas, NLGI has arranged to supply copies of both the picture and the music and effects portions (no English voice narration) as follows:

Picture only (*no voice, no music and effects*)

$200 to members already owning one or more English version prints.

$400 to members not owning any prints.

$300 to non-members already owning one or more prints.

$500 to non-members not owning any prints.

Music and Effects track (for mixing with required foreign language voice and adding to picture copy)

$125 to all purchasers.

The picture supplied will be a "positive print" suitable for showing of itself or as a "master" from which copies can be made. The music and effects track supplied will be either a ¼-in. magnetic tape (Fairchild Pic-Sync System) or a 16-mm magnetic tape, depending on the needs of the purchaser with respect to the facilities available in the country where it is to be processed. The Fairchild tape travels at fifteen inches per second and incorporates a fourteen-kilocycle synchronization signal. For a complete foreign sound film it will, of course, be necessary to purchase copies of both the picture and the music and effects portions. A copy of the film script in English will be provided for translation purposes.

Copies of the English version of "Grease–the Magic Film," may be purchased at any time in accordance with the prices quoted above. A magnetic stripe suitable to receive foreign voice may be obtained on the English version for an additional cost of $35. The use of the magnetic stripe system requires special projection equipment.

NLGI Representatives Named

The Hodson Corporation's new Technical Representative to the Institute is Mr. William C. Bryant, a technical consultant for this Active member firm.

Riley Brothers, Inc., an NLGI Active member, has named Robert Mills, chemist, as Technical Representative.

Recommended Practices Sales Reach 100,000

The one hundred thousand mark was reached and passed this month –more than 100,000 'Recommended Practices for Automotive Front Wheel Bearings" booklets have been distributed since this service manual was offered, two years ago. The latest order from one firm for 5,000 copies was responsible for putting the number of copies so high.

"Recommended Practices" is still available in quantity and a price list may be promptly obtained from the national office.

SERVICE AIDS

- **NLGI MOVIE–"Grease, the Magic Film," a 16-mm sound movie in color running about 25 minutes, now released. First print $600, second print $400, third and subsequent orders $200.**
- **VOLUME XX–Bound volume of the NLGI SPOKESMAN from April, 1956 through March, 1957. An excellent reference source, sturdily bound in a handsome green cover . . . $7.00 (NLGI member price) and $10.00 (non-member) plus postage.**
- **BONER'S BOOK–Manufacture and Application of Lubricating Greases, by C. J. Boner. This giant, 982-page book with 23 chapters dealing with every phase of lubricating greases is a must for everyone who uses, manufactures or sells grease lubricants. A great deal of practical value. $18.50, prepaid.**

THE HAMMER AND THE RETORT

As the geologist's hammer signifies the mineral wealth locked in the earth's crust, the chemical retort signifies the power to free that wealth for the benefit of mankind. Together, the hammer and the retort symbolize the marriage of geology and chemistry that is the tradition and the future of the Foote Mineral Company.

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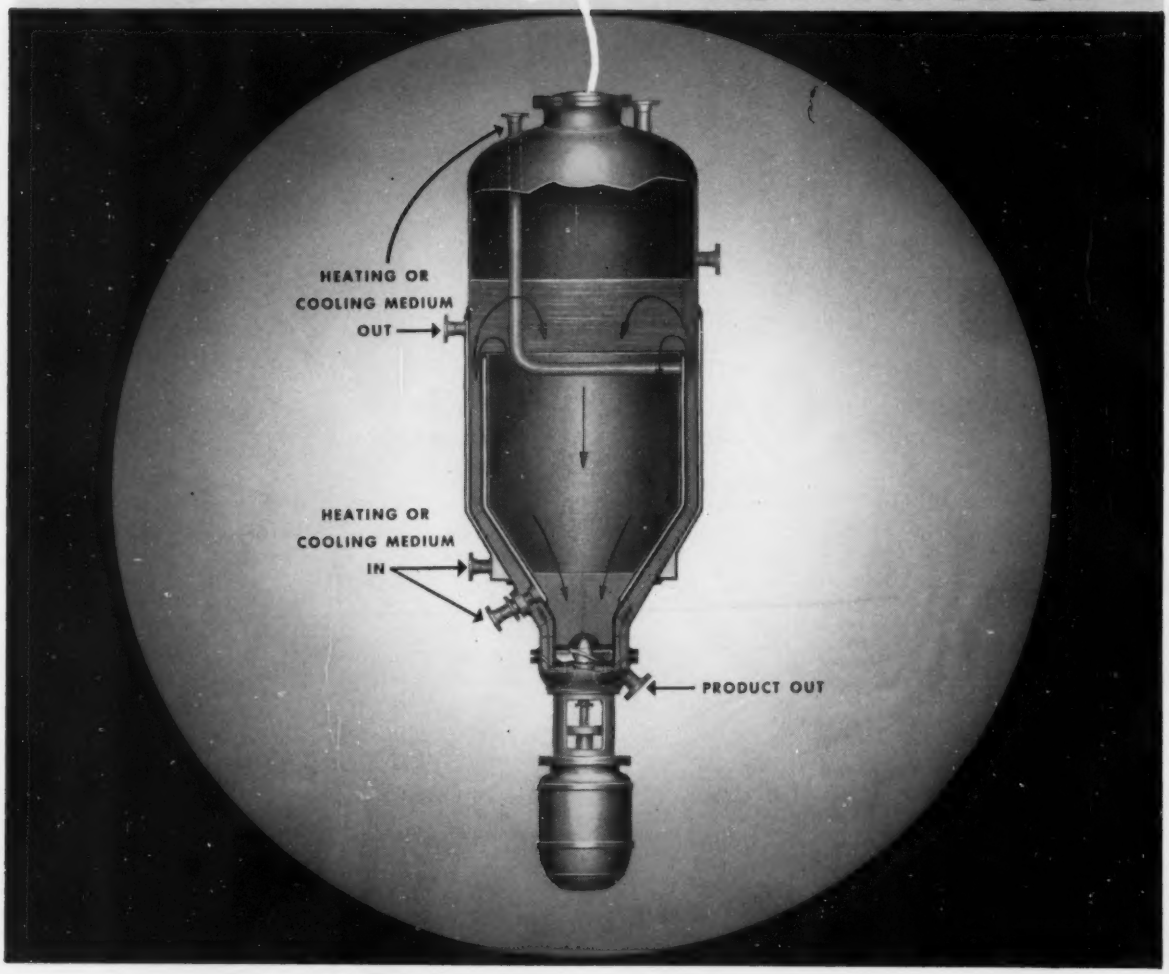

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